

**Department of Commerce
National Institute of Standards and Technology**

**BUDGET ESTIMATES, FISCAL YEAR 2001
CONGRESSIONAL BUDGET SUBMISSION**

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PROPOSED SUPPLEMENTAL BUDGET REQUEST, FISCAL YEAR 2000

Scientific and technical research and services

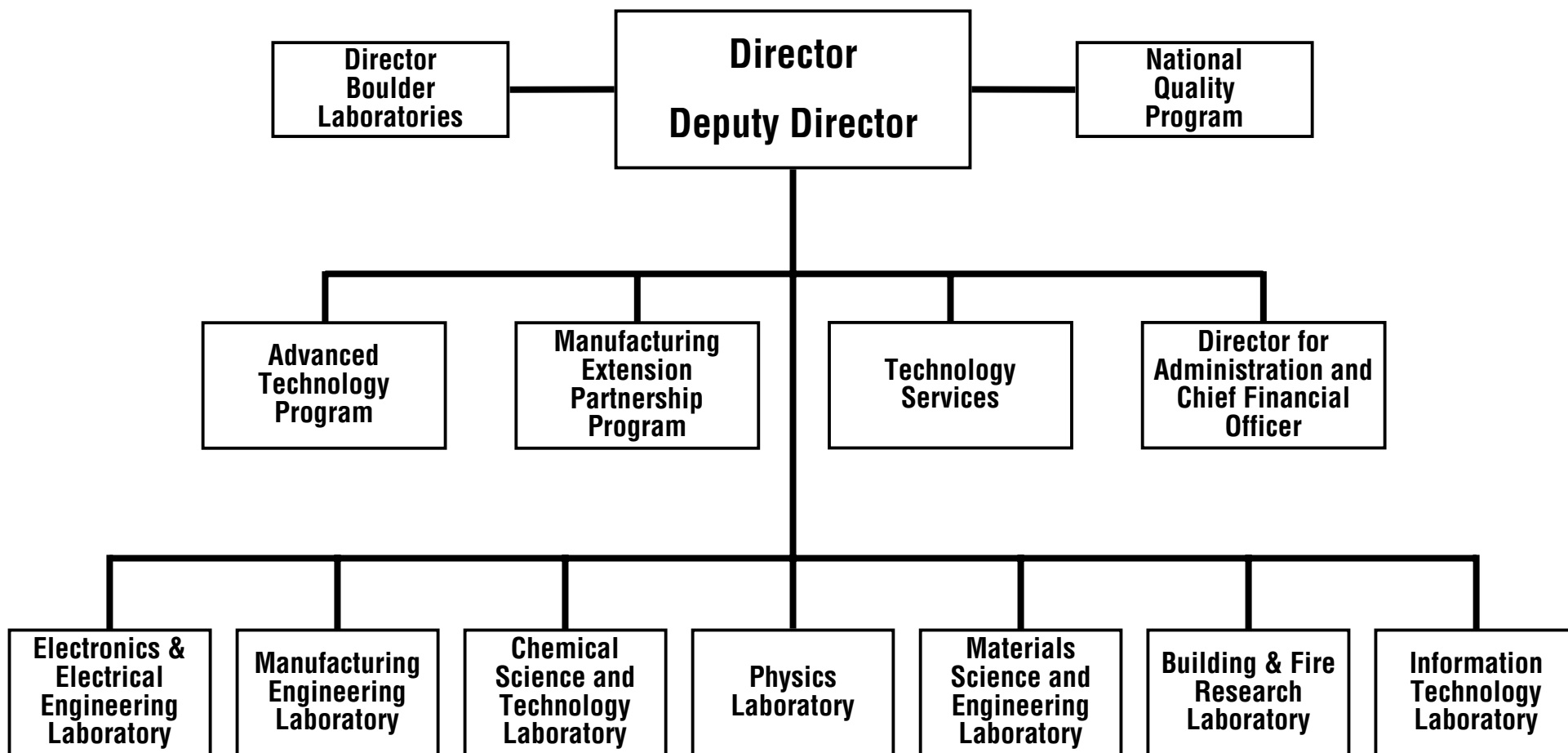
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DEPARTMENT OF COMMERCE
TECHNOLOGY ADMINISTRATION
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Budget Estimates, Fiscal Year 2001
Congressional Submission

GENERAL STATEMENT

Technology is driving growth at every level of our economy. Leading economists estimate that technical change accounts for at least one half of the economic growth in advanced economies around the world. All advanced economies must rely on a technological infrastructure that both sustains economic activity and promotes technological progress. As stated by Secretary of Commerce Daley, "Companies using technologies are more productive and profitable, pay higher wages, and increase employment more rapidly than firms that do not." NIST promotes U.S. economic growth by working with industry to develop and apply technology, measurements, and standards -- providing the basic technical infrastructure needed by industry to transform technology into profits, jobs and new products and services that drive the economy and improve the quality of life for all individuals residing in the U.S.

For FY 2001, NIST is requesting a total budget of \$712,991,000 and 3,230 positions. This request includes adjustments-to-base totaling \$18,954,000 offset by -\$76,204,000 in transfers and appropriation adjustments, for a net -\$57,250,000 and 2 positions, and program changes totaling \$134,443,000 and 124 positions. The FY 2001 request is an increase of \$77,193,000 and 126 positions over NIST's FY 2000 appropriation available.

Goals of the Program

As depicted in the table below, NIST's programmatic goals support two DoC strategic goals: to promote economic growth, and to stimulate innovation for competitiveness.

Alignment of DOC and TA strategic goals

DOC strategic goal 1: promote economic growth	
Goal: Improve the technological capability, productivity, and competitiveness of small manufacturers. <i>NIST: Manufacturing Extension Partnership</i>	Goal: Assist U.S. businesses and other organizations in continuously improving their productivity and efficiency by adopting performance and quality management practices. <i>NIST: Baldrige National Quality Program</i>
DOC strategic goal 2: stimulate innovation for competitiveness	
Goal: Provide technical leadership for the Nation’s measurement and standards infrastructure, and assure the availability of essential reference data and measurement capabilities. <i>NIST: Measurement and Standards Laboratories</i>	Goal: Improve technology’s contribution to U.S. competitiveness, economic growth, and job creation through the analysis, development, advocacy, and implementation of national technology policies and programs. <i>Office of the Under Secretary / Technology Policy</i>
Goal: Accelerate technological innovation and the development of new technologies that underpin future economic growth. <i>NIST: Advanced Technology Program</i>	Goal: Increase the security, reliability, and survivability of the information technology systems and networks that comprise the Nation’s information infrastructure. <i>NIST: Institute for Information Infrastructure Protection</i>

Statement of Objectives

NIST focuses on work that is vital to the country’s technology infrastructure but which neither industry nor the government provides separately. This is work that private companies cannot or will not take on by themselves – either because they cannot capture the broad-based benefits that will accrue to the economy at large or because the tasks are long-term and carry high risks and, therefore, fall outside the scope of what industry can do alone. NIST sets its priorities in close consultation with industry because follow-on investments by the private sector generate the applications that ultimately produce high economic and social benefits to the Nation.

In keeping with these objectives, NIST’s mission is to strengthen the U.S. economy and improve the quality of life by working with industry to develop and apply technology, measurements, and standards. NIST’s vision is to provide U.S. industry with the world’s best technical infrastructure and return the best possible value to the economy and society.

NIST relies heavily on evaluation of its work to ensure that industry and the taxpayers are receiving the greatest possible return on their investment. Rigorous, open, technically sound, and competitive processes are the hallmark of all of NIST's efforts. All of the Institute's programs are merit-based, and NIST continually strives to maintain its reputation for accuracy, quality, and integrity in all of its functions.

NIST's programs span five interrelated areas as described below:

- **Measurement and Standards Infrastructure:** The **Measurement and Standards Laboratories Program** is planned and implemented in cooperation with industry and focused on infrastructural technologies such as measurements, standards, evaluated data, and test methods which provide a common language for use by industry in commerce. NIST-delivered measurement techniques, equipment, calibrations, and standards support innovation, raise quality, and lower transaction costs in virtually all technology-intensive sectors of the economy. In addition, U.S. scientists rely daily on NIST's evaluated data services and measurement expertise for a host of basic and applied research activities. Other key measurement and standards functions, such as the development and maintenance of accurate weights and measures, and the reduction of standards-related barriers to trade, enhance economic efficiency and lower costs in sectors that collectively generate approximately half of the Nation's GDP. The most recent economic impact studies conducted for specific NIST measurement and standards research programs found benefit-cost ratios ranging from 4 to 1 to 100 to 1.
- **Technology Development:** The **Advanced Technology Program (ATP)** accelerates the development of high-risk, broadly enabling technologies, bridging the gap between long-term laboratory research and the marketplace, thereby helping to sustain U.S. global competitiveness. ATP co-funding stimulates corporate investment in path-changing, enabling technologies that otherwise would not have been developed in time to be competitive in world markets, either because the benefits are too widely spread, the risks are too high, or the research is too costly or complex for any single company to address on its own. ATP is in its tenth year of existence, and evidence shows that the program is working. ATP has stimulated collaborative R&D, catalyzed investment in high risk technology development, and accelerated R&D cycles where speed to market determines competitive success. Moreover, economic forecasts indicate ATP's potential for generating broad-based economic impacts; for instance, studies of three ATP projects estimate potential economic benefits that could exceed the total costs of the program to date.
- **Technical Assistance and Technology Diffusion:** The grassroots **Manufacturing Extension Partnership (MEP) Program** strengthens the global competitiveness of smaller U.S.-based manufacturing firms by providing a nationwide network of manufacturing extension centers integrated with Federal, state, local, and private-sector programs. The MEP centers provide access to industrial resources, services, and expertise related to modern best practices and manufacturing methodologies. Studies of companies assisted by MEP extension centers indicate greater improvements in productivity in comparison to non-client companies. Now that MEP has achieved nationwide coverage with extension centers serving all

50 states, the District of Columbia, and Puerto Rico, MEP will focus on optimizing system and center performance, thereby increasing the number of small and medium-sized manufacturers that benefit from MEP's services.

- **Business Quality and Performance Improvement:** The highly visible **Baldrige National Quality Program (BNQP)** enhances the competitiveness, quality, and productivity of U.S. organizations for the benefit of all citizens. The BNQP, which manages the Malcolm Baldrige National Quality Award, strives to make performance excellence a national priority and to disseminate best practices across the United States. Each year, more than 400 experts from industry, universities, government, and non-profit organizations volunteer many hours reviewing applications for the award, conducting site visits, and providing each applicant with an extensive feedback report citing strengths and opportunities for improvement. To date, the Baldrige Award recipients have given more than 30,000 presentations reaching thousands of organizations. Nearly two million hard copies of the Baldrige Criteria for Performance Excellence have been distributed since 1988, and evidence indicates a long-term link between use of the Baldrige Criteria and improved business performance. Health care and education are now benefitting from sector-specific criteria and new award categories.
- **Institute for Information Infrastructure Protection:** The goal of the **Institute for Information Infrastructure Protection (IIIP)** is to increase the security, reliability, and survivability of the information technology systems and networks that comprise the nation's information infrastructure. The IIIP, to be established in FY 2001 and located at NIST, will lead a partnership among industry, academia, and government to develop the R&D capacity, technologies, and knowledge needed to protect the Nation's critical information infrastructure. The ubiquitous and interconnected nature of information technology increases the extent to which singular attacks or failures can broadly affect the Nation's infrastructure and the many industries that depend upon it. The U.S. economy is increasingly dependent upon computers and networks, and the reliability, security, and quality of those systems must be strengthened. Without adequate assurance, the viability of America's networks and infrastructure, and the industries supported by them, is put at risk.

Environmental Assumptions

Globalization is creating policy challenges. The rapid globalization of industry heightens the need to further harmonize divergent national systems of measurement, standards, and conformity assessment. In addition, globalization increases the need for careful coordination and strategic development of all export-related policies. Above all, globalization heightens the importance of maintaining a robust national technical infrastructure to support the rapid development and diffusion of new technologies.

Technological change has accelerated the need for new technical infrastructure capabilities. Next-generation technologies require ever more precise measurements and supporting measurement infrastructure. For instance, rapid growth in the development and application

of information technologies has generated new measurement and standards needs. Moreover, the Nation's rapid and pervasive adoption of digital technologies has elevated the need for a more reliable, secure, and accessible information infrastructure.

Industry relies increasingly on external sources of technology. Competitive pressure for faster cycle times, plus the increased breadth of scientific and technical competencies required at the forefront of technology development, encourage firms to rely upon external sources of technology and expertise, including but not limited to infrastructure technologies. In addition, the productivity of the Nation's businesses is significantly affected by the quality, reliability, and efficiency of the Nation's physical infrastructure.

U.S. firms invest heavily in R&D, but market pressures deter investments in particular types of technology. Because private industry firms must be able to recognize returns on a time frame and at a level satisfactory to investors, they spend about half of what the Federal government does on basic research. For the same reasons, industry will continue to invest relatively less in certain types of technologies: infrastructural technologies, which require distinct competencies and are broadly applied; enabling or multi-use technologies, which benefit multiple segments of an industry or group of industries; and high potential breakthrough technologies, which typically involve risk levels and time frames that far exceed the horizons of individual firms.

Small manufacturers are critical elements in all of the multiple industrial sectors of the Nation's supply chains. They also will continue to generate large numbers of jobs and growth opportunities. However, small firms will continue to rely upon outside expertise as they struggle to overcome knowledge and resource barriers to technology adoption and productivity improvement.

Technology has the greatest positive effect on organizations when it is complemented by high performance management practices. Many U.S. manufacturing firms have demonstrated sustained performance improvements by adopting quality management practices. Many of these benefits have yet to be realized by the Nation's service industries—health care, education, and others—which account for a large and increasing share of the Nation's total output.

In an environment of rapid technological change and global competition, the Department of Commerce will continue to ensure and enhance long-term U.S. economic opportunities through policies and programs that will improve the business climate for innovation and provide the technical capabilities that industry needs to compete.

Summary of Proposed Budget Increases

In concert with the Secretary's goals for this budget, NIST's budget increases support four DoC Secretarial priorities: (1) Accelerating the Transition to Electronic Commerce; (2) Expanding Commerce's Partnerships with Minority-Serving Institutions; (3) Establishing Safeguards Against Unconventional National Security Threats; and (4) Addressing Critical Construction Needs. In addition, NIST's budget increases support three White House initiatives: (1) information technology R&D; (2) nanotechnology; and (3) critical infrastructure protection.

Adjustments to base in all appropriations total \$18,954,000, offset by -\$76,204,000 in transfers and appropriation adjustments, for a net -\$57,250,000 and 2 positions in adjustments to base and built-in changes.

To carry out its mission, goals and objectives, NIST requests program changes totaling \$134,443,000 and 124 positions. Brief descriptions of each program change follow.

The Scientific and Technical Research and Services appropriation request includes program increases totaling \$40,500,000 and 91 positions. Eleven of the positions will be transferred from the NIST Working Capital Fund (WCF). This appropriation request also includes a decrease of \$1,360,000.

Manufacturing Interoperability – NIST requests an increase of \$4,000,000 and 16 positions to improve U.S. manufacturing productivity by ensuring that electronic data between businesses can be exchanged accurately and efficiently.

Nanotechnology – NIST requests an increase of \$10,000,000 and 16 positions to provide measurements and standards, and analysis of commercial potential and global trends for private sector development of advanced nanotechnologies, including applications in most major industrial sectors, such as health care, semiconductors, communications, defense, biotechnology, and magnetic data storage.

Combinatorial Chemistry – NIST requests an increase of \$4,500,000 and 13 positions to build a foundation of measurements and standards to support new combinatorial research and development methods for use by U.S. industry, universities, and government agencies, and for use in NIST metrology research. These methods are dramatically faster than traditional sequential methods of research and will speed the discovery and development of new products and processes.

Wind Research – NIST requests a decrease of \$1,360,000 to reflect the conclusion of a disaster research program on the effects of windstorms on protective structures and other technologies.

CIP Expert Review Team – NIST requests an increase of \$5,000,000 and 11 positions to establish a team of computer security experts

to help Federal agencies protect their information systems in accordance with Presidential Decision Directive (PDD) #63 on critical infrastructure protection, applicable statutes and OMB guidance.

CIP R&D – NIST requests an increase of \$5,000,000 and 8 positions to develop new tools to better protect information technology elements of the Nation’s critical infrastructures through research and development of new measurements, standards, test methods and guidelines that identify and remedy vulnerabilities to natural and intentional disruptions. (All 8 positions are transfers from the NIST WCF).

Information Technology for the 21st Century (IT²) – NIST requests an increase of \$1,000,000 and 3 positions to provide a foundation of measurements and standards to support the rapid advance of information technology in the U.S. by supporting advanced wireless communications technologies. (All 3 positions are transfers from the NIST WCF.)

Postdoctoral Fellowship Program - NIST requests an increase of \$3,000,000 and 22 positions to expand the NIST/National Research Council Postdoctoral Research Fellowship Program to enhance the transfer of advanced technology between universities and NIST; expand the pool of highly skilled scientists and engineers for future NIST positions; and provide temporary staff to more flexibly carry out NIST measurements and standards research in response to changing industry needs.

Minority-Serving Institutions (MSIs) - NIST requests an increase of \$8,000,000 and 2 positions to participate in a DoC-wide effort to develop a high impact, high visibility program for minorities in the sciences and to provide increased contributions of MSIs to the U.S. economic and technology base.

The Industrial Technology Services appropriation request includes program increases for the Advanced Technology Program, the Manufacturing Extension Partnership Program, and the newly proposed Institute for Information Infrastructure Protection totaling \$96,821,000 and 46 positions, and a decrease of \$6,000,000 and 2 positions.

Advanced Technology Program - NIST requests an increase of \$31,821,000 for the continuation of existing ATP projects and to bring the new awards total to \$65,000,000 to support approximately 65 new projects, encouraging industry to identify and pursue innovative ideas in all areas of technology with broad national benefits.

Manufacturing Extension Partnership Electronic Commerce Outreach – NIST requests \$15,000,000 and 4 positions to provide e-commerce outreach to stimulate manufacturers’ and small businesses’ involvement in the digital economy and to support a secure and open environment for electronic commerce.

Manufacturing Extension Partnership Base Reduction - NIST requests a decrease of \$6,000,000 and 2 positions to reflect a realignment of activities to support e-commerce.

Institute for Information Infrastructure Protection (IIIP) – NIST requests an increase of \$50,000,000 and 42 positions to establish and operate an institute to support research and development for protection of the Nation’s critical information infrastructures by collaborating with industrial and academic sectors and providing research grants.

The Construction of Research Facilities appropriation request includes program increases totaling \$4,482,000.

Facilities Technical Obsolescence - NIST requests an increase of \$500,000 to design a new primary electrical service at the NIST Boulder, Colorado, facility.

Safety, Capacity, Maintenance, and Major Repairs - NIST requests an increase of \$3,982,000 to continue addressing the backlog of safety, capacity, maintenance, and major repair projects at both the Gaithersburg, Maryland, and Boulder, Colorado, sites in fiscal year 2001.

Summary of Performance and Resources

Performance: Since its establishment in 1901 as the National Bureau of Standards, NIST has collaborated closely with industry to anticipate and address the Nation's measurement, standards, and technology needs. NIST's extensive and diverse interactions with industry provide an important source of information about the quality, direction, and future demand for NIST products and services.

NIST evaluates its performance and plans its work in part through direct customer feedback, but also through three distinct evaluation mechanisms: peer review and other forms of external assessment; economic impact studies; and quantitative output tracking. As described below, NIST's four programs each use a different mix of these three mechanisms, tailored to each program's purpose and functions. In addition, NIST as a whole, benefits from the agency-wide external reviews and guidance provided by the Visiting Committee on Advanced Technology, a legislatively mandated panel of 15 external advisors that meets quarterly to review NIST's general policy, organization, budget, and programs.

Measurement and Standards Laboratories

NIST has developed a comprehensive and robust performance evaluation system for the Measurement and Standards Laboratories (MSL). The system is based upon three types of performance data: 1) annual peer review of each laboratory's technical quality and direction, augmented by technical capability benchmarking to other national metrology institutes; 2) microeconomic impact studies that assess the long-term impacts of specific research projects; and 3) quantitative output metrics. In addition, NIST uses a wide variety of contacts with its customers to continually evaluate its output relative to the Nation's measurement and standards needs.

NIST developed this diverse performance evaluation system in response to the intrinsic challenges of measuring the performance and long term impact of research programs. First, the primary output of research is scientific and technical knowledge, which itself is difficult to measure directly and comprehensively. Second, the outcomes from research often do not begin to accrue until several years after the research program has been completed, and the diffusion of benefits often affects broad segments of industry and society over long time periods. By utilizing diverse yet complementary sources of performance data, NIST can thoroughly evaluate its products, services, and processes at different stages and from different perspectives.

Peer Review and Benchmarking: Since 1959, the NIST Measurement and Standards Laboratories have been reviewed annually by the National Research Council (NRC). The current NRC Board on Assessment of NIST Programs is composed of approximately 150 scientists, engineers, and other experts from industry, academia, and government agencies, organized into seven panels (one for each of the seven NIST laboratories) plus two sub-panels for specialized programs (Joint Institute for Laboratory Astrophysics (JILA) and the NIST

Center for Neutron Research). Panel reviews are reported at the Division level (the major organizational units for the Laboratories), and build upon assessments of research processes at the project and program levels.

The NRC Board on Assessment review is independent, technically sophisticated, and extensive. Each panel conducts a two- to three-day on-site review of an individual laboratory's technical quality, with particular attention to the following factors:

- The technical merit of the laboratory programs relative to the current state-of-the-art;
- The degree to which the laboratory programs conform to their mission;
- The effectiveness with which the laboratory programs are carried out and the results disseminated; and
- Insofar as they affect the quality of the technical programs, the adequacy of the laboratories' facilities, equipment, and human resources.

The NRC panels reviewed the NIST laboratories during February and March, 1999, and published their findings in the FY 1999 "Assessment of the National Institute of Standards and Technology Measurement and Standards Labs" which can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC web site at: <http://www.nap.edu/books/NI000763/html>. Information on NRC Board on Assessment activities and summary findings for each of the MSL laboratories, excluding Technology Services, are included in each MSL subactivity section in the STRS budget justification. The final report, which serves as a comprehensive annual peer review report of the NIST MSL states that "the technical merit and the appropriateness of the work in all of the laboratories continue to be very high. The staff represents one of the world's finest assemblages of scientific and engineering expertise. The breadth of research programs and laboratory expertise provides leading-edge information and services to both emerging and mature industries." This report not only provides an external quality assessment for GPRA purposes, but also provides each laboratory with a valuable source of information for its own performance assessment, planning, and management functions. In addition, NIST's Visiting Committee on Advanced Technology uses the NRC report and associated briefings within its evaluation of NIST as a whole.

NIST complements the NRC's assessment of technical quality with its own benchmarking data. NIST must perform world-class research to provide technical leadership for the Nation's measurement infrastructure and maintain the best measurement capabilities in the world. To track their performance and facilitate planning, the NIST laboratories conduct ongoing benchmarking assessments of their measurement capabilities relative to other national metrology institutes (NMIs) and measurement laboratories. This activity also assesses U.S. industry's evolving measurement and standards needs. To remain innovative and internationally competitive, U.S. industry must have access to the best available technology infrastructure. NIST's status as a leading NMI also provides a basis for combating technical barriers to U.S. exports, such as product acceptance testing requirements that vary from U.S. measurement standards and practices. Illustrative examples of benchmarking data for the NIST MSL are included below:

Quantity	Unit	Range	Capability relative to other NMIs	U.S. Economic Sectors Supported
Impedance	farad	$10^{-12} - 10^{-8}$	Best in the World	Electronic instrumentation manufacturers; Aerospace and other transportation/communication sectors; Sensors for manufacturing; Semiconductor processing; Electric utilities
	ohm	$10^{-4} - 10^{12}$	Best in the World	Electronic instrumentation manufacturers; Aerospace; Sensors for manufacturing; Semiconductor processing; Electric utilities
Voltage	dc volt	1, 10	Best in the World	Electronic instrumentation manufacturers; Aerospace; Sensors for manufacturing; Medical applications
	ac-dc difference	2 Hz – 1 MHz	Best in the World	Electronic instrumentation manufacturers; Aerospace; Sensors for manufacturing; Electric power generation, transmission, and distribution
Power and Energy (Low Frequency)	watt	69 – 480 volts 0.5 – 30 amperes 50, 60, 400 Hz	State-of-the-Art, comparable to best NMIs	Electric power generation, transmission, and distribution; Appliance manufacturers; Welding; Electric vehicles
High Voltage	volt	60 Hz and pulsed 600 V and up	State-of-the-Art, comparable to best NMIs	Electric power generation, transmission, and distribution; Appliance manufacturers; Welding; X-rays/medicine

Quantity	Unit	Range	Capability relative to other NMIs	U.S. Economic Sectors Supported
Amount of substance	Mol – inorganics	$10^{-6} - 10^{-1}$ mol/mol	Best in the world	Aerospace, metals, environmental monitoring
	Mol – organics	$10^{-6} - 10^{-1}$ mol/mol	Best in the world	Environmental/health measurements, agricultural and food processing, petroleum, advanced materials
	Mol – Gases	$10^{-15} - 10^{-1}$ mol/mol	Best in the world	Automotive, power plant emissions trading, specialty gas manufacturers
Temperature	Kelvin	0.65 – 25 K	Best in the world	Instrument manufacturing, aerospace
		13.8 – 273.16 K	Best in the world	Cryogenics, refrigeration
		83.8 – 934 K	Best in the world	Chemicals, petrochemicals
		273.16 – 1235 K	Best in the world	Medical applications, semiconductors
Pressure & vacuum	Pascal	Vacuum < 0.1 Pa	Best in the world	Vacuum processing, semiconductors
		0.1 Pa – 350 kPa	Best in the world	Aircraft altitude, health care
		10 kPa – 270 Mpa	State-of-the-art	Valve manufacturers
Liquid density	Gram/meter ³	0.85 – 1.1 g/cm ³	State-of-the-art	Petroleum, alcohol, natural gas
		1.1. – 3.0 g/cm ³	State-of-the-art	Nuclear utilities
Humidity (moisture concentration in gases)	Mol of water/	5 nmol/mol – 10 mmol/mol	Best in the world	Semiconductors, nuclear utilities
	Mol of carrier gas	1 µmol/mol – 0.1 mol/mol	Best in the world	Food and chemical processing, instrument manufacturers

Quantity	Unit	Range	Capability relative to other NMIs	U.S. Economic Sectors Supported
Liquid flowrate	Kilogram/sec	0.1 – 150 g/s - (hydrocarbons).	Best in the world	Aerospace (aircraft engines)
		0.01 – 600 kg/s (water)	State-of-the-art	Potable water, electric power generation
Air speed	Meter/sec.	0.15 – 10 m/s	Best in the world	Environmental monitoring
		4.0 – 67 m/s	Best in the world	Weather observations
Length (iodine stabilized laser wavelength)	Meter	Not Applicable	State-of-the-art	Primary method to realize the unit (below are specific application areas)
SEM magnification SRMs	Meter	0.5 μm – 50 μm	Best in the world	Semiconductors, mass storage industry, instrument manufacturers
Length stds. for calibrating coordinate meas. Machines	Meter	0.05m – 1m	State-of-the-art	Discrete parts, aerospace, heavy equipment, optical components, automotive
Surface finish	Meter	0 μm – 50 μm	State-of-the-art	Discrete parts, optical components
IC photomask linewidth	Meter	0.5 μm – 30 μm	Best in the world	Semiconductors
IC photomask pitch	Meter	2 μm – 70 μm	State-of-the-art	
Linescales	Meter	2 μm – 1 m	Best in the world	
Gage blocks (Interferometric)	Meter	1 mm – 100 mm	State-of-the-art	Discrete parts, aerospace, heavy equipment, automotive
Mass	Kilogram	1 mg – 1 g	Best in the world	Transducer manufacturers, aerospace, automotive, buildings, nuclear utilities, weighing industry, equity-in-trade
		1 kg	State-of-the-art	
		10 kg – 10 ⁴ kg	Not state-of-the-art	
Force	Newton	4.4 N – 4.5 MN	Best in the world	Transducer manufacturers, aerospace, automotive, buildings, nuclear utilities
		4.5 MN – 50 MN	State-of-the-art	
Acceleration	Meter/sec ²	9.8 m/s ² (5 Hz – 20 kHz)	State-of-the-art	

Quantity	Unit	Range	Capability relative to other NMIs	U.S. Economic Sectors Supported
Acoustic pressure	Pascal	50 Hz – 20 kHz	State-of-the-art	
Ultrasonic power	Watts	10 mW – 1 W	Best in the world	Health care

Key: “Best in the world” = only NMI at this level of practice; “State of the art” = one or more NMIs also at this level; “Not state of the art” = below other NMIs

Microeconomic Impact Assessments: NIST augments the performance data obtained through benchmarking and peer review with formal microeconomic impact assessments of the long-term impacts of MSL R&D programs. Impact assessments of NIST’s R&D in specific technical areas are conducted by external economic and technical experts contracted by NIST. These studies provide both qualitative assessments and quantitative estimates of the economic impacts resulting from the different types of technology infrastructure that NIST provides to U.S. industry. Quantitative estimates are provided as cost-benefit ratios and/or social rates of return. Due to the cost and complexity of these in-depth studies, NIST can commission only a few per year. By their nature, these studies are retrospective, and because considerable time is required to allow impacts to appear and be measured, the actual impact data and analyses are usually available only after several years have elapsed since the project began.

The impact studies conducted to date consistently show high rates of return from NIST research, relative to both private investments in technology and other public technology investments. These results are not surprising, given that NIST targets its research at specific infrastructure problems that typically are faced by a large number of firms and/or industries and which have been identified through cooperative strategic planning with industry. The results of these impact assessments not only respond to the need to measure and analyze current and past performance, but also contribute to on-going project management and strategic planning needs.

Each MSL subactivity section in the STRS budget justification includes information on economic impact studies and results.

Quantitative Output Metrics: In part, due to the long time frame and intermittent character of economic impact assessments, NIST also tracks MSL activities through a series of quantitative output metrics. These measures convey useful information to management regarding the generation of particular NIST products and services, such as Standard Reference Materials, databases, calibration services, etc. However, these measures do not comprehensively represent the output from NIST laboratories, nor do they provide information about the quality or impact of particular products and services. Moreover, their interpretation requires careful attention to the meaning and context of each measure. For instance, NIST generates a great deal of valuable intellectual property, but chooses to patent that knowledge only when patenting represents the best mechanism for quickly and widely disseminating the knowledge to industry. Consequently, a stable (versus an increasing) trend line for patents and licenses may represent an optimal outcome.

Specific examples of quantitative performance measures for all NIST research programs are summarized as follows:

Quantitative Performance Measures
(All Sources of Funding)

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
<u>Services Output</u>							
- Standard Reference Data (SRD)							
-- collections available (PC software and on-line)	60	63	66	68	70	72	74
- Standard Reference Materials (SRM) available for sale	1,288	1,300	1,315	1,325	1,335	1,350	1,350
- National Voluntary Laboratory Accreditation							
-- total accreditations ¹	873	830	840	850	850	875	900
- Technology Support							
-- NIST patents filed and licenses issued	32	40	40	40	40	40	40
-- standards committees involving NIST staff	1,175	1,175	1,175	1,175	1,175	1,175	1,175
-- chairmanships held by NIST staff on standards committees	129	129	129	129	129	129	129
-- NIST staff on international committees	88	88	88	88	88	88	88
-- leadership positions held on international committees	29	29	29	29	29	29	29

¹ Decreases in accreditations in fiscal years 1999 and 2000 result from major changes in the Fastener Quality Act and some attrition of asbestos laboratories. Increases in accreditations for fiscal years 2001 and beyond result from the calibration Laboratory Accreditation Program (LAP) and anticipated new programs.

Quantitative Performance Measures (continued)
(All Sources of Funding)

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
- Other Information Exchange							
-- number of NIST technical publications	2,414	2,450	2,450	2,300	2,300	2,300	2,300
-- number of major NIST-sponsored conferences & workshops	100	100	120	120	120	120	120

Product and Service Distribution/Trends/Outputs

- Calibration and Testing							
-- number of items calibrated ²	3,118	3,200	3,100	3,000	3,000	3,000	2,900
- SRM							
-- number of units sold ²	33,347	34,000	34,000	33,500	33,500	33,500	33,500
- SRD							
-- number of PC software database units distributed	4,900	5,000	5,100	5,200	5,300	5,400	5,500

² NIST estimates flat or gradual decreases over time in some areas as many of its customers rely increasingly on secondary laboratories that can provide services based on NIST primary standards.

Advanced Technology Program

The ATP continuously strives to define the state-of-the-art in technology impact/outcome evaluation. Highly qualified academic and consulting economists and other experts in evaluation, in addition to in-house staff, assist ATP in planning, modeling, and developing databases, and in conducting surveys, case studies, statistical and econometric analyses, and other studies to measure program performance and improve the quality and reliability of performance metrics.

The ATP has developed a multi-faceted evaluation strategy in consultation with leading economists in the field of technological change. The main components of this strategy are:

- statistical profiling of applicants, projects, participants, technologies, and target applications;
- real-time monitoring of project developments by ATP staff;
- status reports on completed projects;
- interim measures of awardee progress towards developing and commercializing funded technologies;
- microeconomic case studies that focus in detail on project developments and outcomes over defined periods;
- macroeconomic projections of long-term project and program impacts and empirical assessment of long-term outcomes; and
- methodological research to improve the tools of evaluation.

ATP's Applicant Database and Awards Database provide important descriptive information about applicants and the portfolio of ATP projects. These databases are augmented by a unique, integrated set of databases, called the "Business Reporting System," that is used to track the evolution of projects toward achieving their business and economic goals during the projects and extending into the post-project periods. All projects funded by ATP since 1993 and their participants are included in this reporting system. Third-party surveys are conducted periodically to provide updates on projects not in this system.

The Business Reporting System and survey data enable comprehensive statistical analyses of awardee progress. For example, a study of over 200 ATP projects funded from 1993-1995 shows more than 1,000 potential applications that have been identified for the technologies under development. It also shows that the ATP is having a significant impact on the ATP-funded technology development areas, by increasing industry's investment, accelerating the R&D process, stimulating broader-scope and more challenging technology development, and reducing the time-to-market in highly competitive markets. Eighty-six percent of ATP-funded organizations indicate they are already ahead in their R&D cycle as a result of ATP funding. Speed-to-market is considered "critical" or "important" for 98 percent of the commercial applications, and, even though most of the projects analyzed were at an early stage of R&D, about ten percent of companies, representing 15 percent of projects, indicated they have earned early revenues. Acceleration in time-to-market by two years or more is anticipated for 62 percent of planned commercial applications. The results are documented in *Development, Commercialization, and*

Diffusion of Enabling Technologies, Progress Report for Projects Funded 1993-1995, one of a series of studies resulting from ATP's evaluation and analysis efforts.

A status report of the first 38 ATP projects completed found that 60 percent had achieved early commercialization, a significant percentage of the others had commercialization efforts underway, and patent filings and publications were extensive in many of the projects. Of the 27 small, single-applicant companies, nearly 60 percent have more than doubled in size.

In another study, economists at the Research Triangle Institute (RTI) developed a model for predicting the long-term social benefits of ATP's investment in medical technologies and applied the model in a preliminary analysis of seven ATP-funded tissue-engineering projects. Study estimates are that ATP's investment of \$15.5 million may result in societal benefits worth billions of dollars.

In addition to these case studies, the ATP is funding a number of studies by leading researchers through the National Bureau of Economic Research to increase understanding of the underlying relationships among research, innovation, and economic growth. For example, one such study nearing completion investigates the use of joint ventures by businesses to create options in emerging technologies. Another examines the role that universities are playing in ATP projects.

Manufacturing Extension Partnership

The MEP has a number of evaluation and assessment activities in place to improve program management and performance, demonstrate its benefit to the Nation, and respond to the requirements of GPRA. These activities include:

- independent assessment of MEP programs, plans, and policies by the MEP National Advisory Board;
- legislatively-mandated independent panel reviews of individual MEP center operations and outcomes conducted against criteria adapted from the Malcolm Baldrige National Quality Award; and
- regular program oversight and periodic review of individual MEP center operations and outcomes by NIST staff.

These reviews and assessments utilize a variety of metrics, including:

- output tabulations, such as the number of companies served and the number of activities completed;
- interim impacts on client competitiveness, such as increased sales, cost savings, capital investment, and inventory reductions which are collected via regular surveys conducted by the Census Bureau on behalf of MEP;
- special studies of program effectiveness and economic impacts; and
- analysis of more detailed information regarding the operations and performance of individual centers.

The Census Bureau surveys of MEP clients are designed to measure improvements in client firm business performance. While most MEP centers have been providing services for only a few years, results of these surveys indicate that MEP's network of manufacturing extension services is fostering significant improvements in manufacturing and business performance. For example, based on a recent survey of MEP client companies around the country, for FY 1998 alone, MEP services generated at least \$327 million in new sales, \$33 million in labor and material savings, \$24 million in inventory reductions, and leveraged approximately \$265 million in additional capital investment by client firms.³ These estimates are conservative, as they represent only some of the positive impacts MEP generates and do not reflect recurring or cumulative impacts.

MEP's National Advisory Board (MEPNAB) was created to provide guidance and advice on the MEP program from the perspective of its customers and providers who have a vision of industrial extension with a national scope. The Board represents the views and needs of various stakeholders on MEP programs, plans, and policies -- reviewing the soundness of MEP strategies and assessing current performance of the program against MEP's goals. The Board comprises prominent leaders from industry, state and local governments, academia, and labor who are selected for their expertise in manufacturing and industrial extension as well as their work on behalf of small manufacturers. The Board met three times during FY 1999. Some of the major topics covered were: MEP's 1999 program priorities; the Y2K supplemental; 1999 - Year of the Small Manufacturer; and various diffusion and integration projects. The MEPNAB also established a subcommittee to review the MEP evaluation process and formally submitted their findings to Congress.

Baldrige National Quality Program

The Baldrige National Quality Program (BNQP) has its performance evaluated by its Board of Overseers, a prestigious group of national quality, business, education and health care experts, which serves as a Federal advisory panel to the Secretary of Commerce. An important part of the Board's responsibility is to assess how well the BNQP is serving the national interest. The Board reviews all aspects of the BNQP, including the adequacy of the Evaluation Criteria and processes for making Baldrige Awards, and reports its recommendations to the Secretary. Other annual reviews are provided to NIST by the Panel of Judges and the Foundation for the Malcolm Baldrige National Quality Award. Moreover, the House Committee on Science, Space and Technology conducts periodic oversight hearings involving winners of the award, NIST, and outside experts to review the program's effectiveness and management issues. In addition, to assure ongoing responsiveness to the needs of U.S. industry and business, the BNQP utilizes an improvement questionnaire and annual Improvement Day. The BNQP uses several metrics for assessing information dissemination and outreach, including the number of BNQP documents viewed or downloaded from the World Wide Web, the number of criteria mailed, the number of state and local quality award

³ Reflects updated data as of September 1999.

programs supported by BNQP, and tracking the number of presentations given by award winners. Ultimately, the program's effectiveness is evaluated by its impact on the performance of award recipients and other users of the criteria.

A series of five NIST stock investment studies consistently show that quality management is associated with impressive returns. In the most recent study, a hypothetical investment of \$1,000 was made in the Standard and Poor's 500 and in each of the publicly traded companies that has won the Malcolm Baldrige National Quality Award from 1988-1997. For the time the investment was tracked, the 23 award-winning companies outperformed the S&P 500 by about 2.5 to 1, a 426 percent return on investment compared to a 173 percent return for the S&P 500. The six whole company winners did somewhat better, outperforming the S&P 500 by 2.6 to 1 and achieving a 460 percent return on investment compared to a 175 percent return for the S&P 500, and the 23 publicly traded site-visited companies outperformed the S&P 500 by 2.5 to 1. This comparison suggests that successful companies, from the market's standpoint, tend to be those that implement quality and performance management practices. To more rigorously assess the effect of the BNQP on corporate performance, the BNQP recently initiated a formal economic impact study.

Construction of Research Facilities

The current plan for NIST's Construction of Research Facilities program is the culmination of a long and thorough effort to ensure NIST keeps pace with advances in science and technology. NIST's FY 2001 request includes an increase of \$500 thousand to design a new primary electrical service at the NIST laboratory in Boulder, Colorado.

NIST is also requesting \$3.982 million to continue addressing the backlog of safety, capacity, maintenance, and major repair projects at both the Gaithersburg, Maryland, and Boulder, Colorado, sites in fiscal year 2001.

Performance measures for these programs are to keep construction projects within 10 percent of budget and schedule and to keep downtime for existing facilities within 10 percent.

Resources: The following is a comparison of NIST's FY 2000 appropriation available with its FY 2001 budget request and related data on employment.

Appropriation	(Dollar amounts in thousands)					
	2000 Appropriation Available		2001 Estimate		Increase or (Decrease) from 2001 Base	
	Permanent Positions	Amount	Permanent Positions	Amount	Permanent Positions	Amount
Scientific & Technical Research & Services	1,987	\$282,138	2,080	\$337,508	91	\$39,140
Industrial Technology Services	379	246,780	423	339,604	44	90,821
Construction of Research Facilities	32	106,880	32	35,879	0	4,482
TOTAL	2,398	635,798	2,535	712,991	135	134,443

Reimbursable Program

NIST's reimbursable services consist of technical work performed for other Federal agencies, state and local governments, and the private sector.

They include calibrations and special tests, advisory services, and the sale of Standard Reference Materials. The unique measurements and standards expertise developed with appropriated funding gives NIST the capability to perform these services on a reimbursable basis. NIST accepts other-agency work based on an established set of criteria which include (1) the need for traceability of measurements to national standards; (2) the need for work which cannot or will not be addressed by the private sector; (3) work supported by legislation that authorizes or mandates certain services; (4) work which would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and (5) requests by the private sector for NIST action or services. In FY 1999, NIST's reimbursable program totaled \$125 million; the estimates for FY 2000 and FY 2001 are \$108 million each. Reimbursable permanent positions total 706 in FY 1999, with estimates of 706 in FY 2000, and 695 in FY 2001. NIST permanent positions in FY 1999 totaled 3,162 with estimates of 3,104 in FY 2000, and 3,230 in FY 2001.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

Page No.		Positions	FTE	Budget Authority	Direct Obligations	Appro- priation
	Currently Available, 2000	1,987	2,048	\$282,138	\$290,076	\$282,138
	less: Unobligated balance from prior year	0	0	0	(6,938)	0
NIST- 27	plus: 2001 Adjustments to base	2	2	17,230	16,230	17,230
	less: Prior year recoveries	0	0	(1,000)	0	(1,000)
	2001 Base Request	1,989	2,050	298,368	299,368	298,368
	plus: 2001 Program changes	91	63	32,940	32,940	39,140
	2001 Estimate	2,080	2,113	331,308	332,308	337,508

			1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
			Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount
<u>Comparison by activity:</u>												
Measurement and engineering research and standards												
NIST- 37	Electronics and electrical engineering	Pos./Approp	281	\$38,268	272	\$38,376	272	\$40,046	272	\$40,046	0	\$0
		FTE/Obl.	283	38,490	282	39,051	282	40,127	282	40,127	0	0
NIST- 45	Manufacturing engineering	Pos./Approp	146	19,281	140	19,057	140	19,782	156	23,782	16	4,000
		FTE/Obl.	147	19,123	144	19,299	144	19,821	156	23,571	12	3,750
NIST- 61	Chemical science and technology	Pos./Approp	232	32,327	225	32,117	225	33,295	225	33,295	0	0
		FTE/Obl.	234	31,991	232	32,481	232	33,360	232	33,360	0	0
NIST- 69	Physics	Pos./Approp	171	28,290	164	28,423	164	29,454	180	39,454	16	10,000
		FTE/Obl.	172	29,051	169	28,778	169	29,556	181	37,756	12	8,200
NIST- 89	Materials science and engineering	Pos./Approp	358	51,114	348	51,013	352	54,486	365	58,986	13	4,500
		FTE/Obl.	361	50,037	358	53,129	361	54,658	371	57,658	10	3,000

			1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base		
<u>Comparison by activity:</u>			<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	
NIST-105	Building and fire research	Pos./Approp	106	14,829	100	14,732	100	15,248	100	13,888	0	(1,360)	
		FTE/Obl.	108	14,941	104	14,887	104	15,292	104	13,932	0	(1,360)	
NIST-115	Computer science and applied mathematics	Pos./Approp	337	43,759	330	44,232	330	45,347	352	56,347	22	11,000	
		FTE/Obl.	339	42,479	338	45,267	339	45,551	355	55,751	16	10,200	
NIST-145	Technology assistance	Pos./Approp	122	17,043	118	17,363	116	17,197	116	17,197	0	0	
		FTE/Obl.	123	17,624	124	17,708	122	17,349	122	17,349	0	0	
NIST-151	National quality program	Pos./Approp	39	4,850	38	4,903	38	5,191	38	5,191	0	0	
		FTE/Obl.	39	3,877	40	5,913	40	5,205	40	5,205	0	0	
NIST-159	Research support activities	Pos./Approp	255	29,971	252	31,922	252	38,322	276	49,322	24	11,000	
		FTE/Obl.	256	31,681	257	33,563	257	38,449	270	47,599	13	9,150	
TOTALS			Pos./Approp	2,047	279,732	1,987	282,138	1,989	298,368	2,080	337,508	91	39,140
			FTE/Obl.	2,062	279,294	2,048	290,076	2,050	299,368	2,113	332,308	63	32,940
Adjustments to obligations:													
Prior year recoveries				(835)		(1,000)		(1,000)		(1,000)		0	
Unobligated balance, start of year				(6,063)		(6,938)		0		0		0	
Unobligated balance, end of year				6,938		0		0		0		0	
Financing from transfers:													
Transfers to other accounts (+)				398		0		0		6,200		6,200	
Appropriation			279,732		282,138		298,368		337,508		39,140		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	<u>Perm Pos</u>	<u>FTE</u>	<u>Amount</u>
<u>Transfer:</u>			
Transfer of FCS payments to ITA.....	(2)	(2)	(\$750)
Transfer of FARS resources to NIST.....	766
Transfer to GA for security.....	(482)
<u>Adjustments:</u>			
Restoration of FY 2000 Deobligation Offset.....	1,000
<u>Financing:</u>			
FY 2001 Deobligation Offset.....	(1,000)
<u>Other Changes:</u>			
2000 Pay raise (annualization).....	1,945
2001 Pay raise.....	4,656
Annualization of positions financed in FY 2000.....	...	1	...
Within-grade step increases.....	1,514
One less compensable day.....	(613)
Personal Benefits:			
Civil Service Retirement System (CSRS).....	(458)
Federal Employees' Retirement System (FERS).....	576
Thrift Savings Plan (TSP).....	108
Federal Insurance Contribution Act (FICA).....	370
Health Insurance.....	667
Employees' Compensation Fund.....	(54)

	<u>Perm Pos</u>	<u>FTE</u>	<u>Amount</u>
Travel and transportation of persons:			
Per diem.....	...	...	131
Common carrier.....	...	...	105
Transportation of things.....	...	...	12
Rental payments to GSA.....	...	...	1
Rental payments to others.....	...	...	40
Communications, utilities, and miscellaneous charges.....	...	...	147
Printing and reproduction.....	...	...	26
Other services:			
Executive development & leadership training (SES 2000)	...	...	220
Working Capital Fund (GA).....	...	...	68
Financial Management System .....	...	...	4,422
NARA storage costs.....	...	...	(1)
Other contracts/services.....	...	...	558
Reactor License Renewal.....	4	3	600
NRC License Fees.....	...	...	1,076
Supplies and materials.....	...	...	248
Equipment.....	<u>...</u>	<u>...</u>	<u>332</u>
Total, Adjustments to Base.....	2	2	16,230

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

FTE Amount

Transfer:

Transfer of Foreign Commercial Service payments to ITA..... (2) (\$750)

This adjustment to base (ATB) reflects the transfer of \$750,000 to the Department of Commerce International Trade Administration (ITA) for support of standards attaches in Brasilia, Mexico City, and Brussels previously funded on contract by NIST. House Report 105-207 directs that NIST not support any additional standards attaches. This role has been shifted to ITA, which is establishing additional standards attache positions in other key emerging markets.

Transfer of FARS resources to NIST 0 766

The Department of Commerce is requesting a transfer of \$766,000 in implementation resources from DOC FARS customers to NIST. NIST will use these resources to partially fund the implementation of a new integrated financial management system, which will provide financial services to DoC customers currently services through FARS. DoC FARS customers include: the Office of the Secretary, the Economic Development Administration, the Economics and Statistics Administration, the Bureau of Economic Analysis, the Minority Business Development Administration, the Office of Computer Services (Springfield), and the Office of the Inspector General.

Transfer to GA for security..... 0 (482)

A decrease of \$482,000 reflects a transfer to the General Administration appropriation for security costs previously funded by the GA, WCF.

Adjustments:

Restoration of FY 2000 Deobligation offset 0 1,000

In FY 2000, NIST's budget authority was reduced by \$1,000,000 based on an estimated level of prior year deobligations. This adjustment would restore the reduction in FY 2001.

Financing:

FY 2001 Deobligation offset 0 (1,000)

NIST's FY 2001 budget authority is being reduced by the estimated level of prior year deobligations.

Other Changes:

2000 Pay raise (annualization) 0 1,945

A pay raise of 4.8 percent was effective January 1, 2000.

Total cost in FY 2001 of 2000 pay raise	\$7,230,000
Less amount requested in FY 2000	(5,207,000)
Less amount absorbed in FY 2000	(94,000)
Amount requested in 2001 to provide full-year cost of 2000 pay raise	1,929,000
Payment to Working Capital Fund	<u>16,000</u>
Total, FY 2000 pay raise increase in FY 2001	1,945,000

2001 Pay increase and related costs.....	0	4,656
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A general pay raise of 3.7 percent is assumed to be effective January 1, 2001.

Total cost in FY 2001 of pay increase.....	\$4,608,000
Less amount absorbed in FY 2001	<u>0</u>
Amount requested for FY 2001 pay increase	4,608,000
Payment to Working Capital Fund.....	<u>48,000</u>
Total adjustment for FY 2001 pay increase	4,656,000

Annualization of positions financed in FY 2000.....	1	0
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STRS requires an additional 1 FTE to staff FY 2000 enacted increases at their full operating level in FY 2001.

Within-grade step increases	0	1,514
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An increase of \$1,514,000 is required to cover the cost of within-grade step increases.

One less compensable day.....	0	(613)
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The decreased cost of one less compensable day in FY 2001 compared to FY 2000 is calculated by dividing the FY 2000 estimated personnel compensation and applicable benefits by 261 compensable days.

Personnel benefits.....	0	1,209
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Civil Service Retirement System (CSRS).....	(458)
Federal Employees' Retirement System (FERS).....	576
Thrift Savings Plan (TSP)	108
Federal Insurance Contribution Act (FICA) - OASDI	370
Health Insurance.....	667
Employees' Compensation Fund.....	(54)

Civil Service Retirement System (-\$458,000) - The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will drop from 39.2 percent in FY 2000 to 35.1 percent in FY 2001. Contribution rates will remain the same.

Payroll subject to retirement systems (\$131,193,000)	
Cost of CSRS contributions in FY 2001 ($\$131,193,000 \times .351 \times .0851$)	\$3,918,748
Cost of CSRS contributions in FY 2000 ($\$131,193,000 \times .392 \times .0851$)	<u>4,376,494</u>
Total adjustment-to-base	(457,745)

Federal Employees' Retirement System (\$576,000) - The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will rise from 60.8 percent in FY 2000 to 64.9 percent in FY 2001. The contribution rate will remain at 10.7 percent in FY 2001.

Payroll subject to retirement systems (\$131,193,000)	
Basic benefit cost in FY 2001 ($\$131,193,000 \times .649 \times .107$).....	\$9,110,435
Basic benefit cost in FY 2000 ($\$131,193,000 \times .608 \times .107$).....	<u>8,534,892</u>
Total adjustment-to-base	575,543

Thrift Savings Plan (\$108,000) - The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate is expected to remain 2 percent.

Thrift plan cost in FY 2001 ($\$131,193,000 \times .649 \times .02$)	\$1,702,885
Thrift plan cost in FY 2000 ($\$131,193,000 \times .608 \times .02$)	<u>1,595,307</u>
Total adjustment-to-base	107,578

Federal Insurance Contributions Act (FICA) - OASDI (\$370,000) - As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will rise from \$73,275 in FY 2000 to \$78,450 in FY 2001. The OASDI tax rate will remain 6.2 percent in FY 2001.

FERS payroll subject to FICA tax in 2001 ($\$131,193,000 \times .649 \times .932 \times .062$).....	\$4,919,976
FERS payroll subject to FICA tax in 2000 ($\$131,193,000 \times .608 \times .925 \times .062$).....	<u>4,574,542</u>
Increase (FY 2000-FY 2001).....	345,434
OTP payroll subject to FICA tax in FY 2001 ($\$9,307,000 \times .649 \times .932 \times .062$).....	\$349,029
OTP payroll subject to FICA tax in FY 2000 ($\$9,307,000 \times .608 \times .925 \times .062$).....	<u>324,524</u>
Change (FY 2000-FY 2001).....	24,505
Total adjustment-to-base	369,939

Health insurance (\$667,000) - Effective January 1999, NIST's contribution to Federal employees' health insurance premiums increased by 12.3 percent. This percentage was applied against the FY 2000 estimate.

Employees Compensation Fund (-\$54,000) - The Employees' Compensation Fund bill for the year ending June 30, 1999 is \$93,780 lower than the bill for the year ending June 30, 1998. The STRS share of this decrease is \$54,160. The charges will be reimbursed to the Department of Labor pursuant to 5 U.S.C. 8147.

Travel and transportation of persons..... 0 236

Per Diem (\$131,000) - Effective January 1999 the General Services Administration raised per diem rates. This increase results in a 3.9 percent increase to NIST. This percentage was applied to the FY 2000 estimate.

Common Carrier (\$105,000) – An additional \$105,000 is requested to cover the cost of purchasing airline tickets in contracting with a travel agency under the new method.

Transportation of things..... 0 12

The cost of transporting such things as household goods, scientific instruments, and hazardous materials increased during the past year. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate.

Rental payments to GSA.....	0	1
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GSA rates are projected to increase 2.1 percent in FY 2001. This percentage was applied to the FY 2000 estimate.

Rental payments to others	0	40
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An increase of \$40,000 is required to pay the increased costs of rental payments to others. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate.

Communications, utilities, and miscellaneous charges	0	147
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This adjustment to base is required to pay the additional cost of communications and miscellaneous charges. The increased cost are based on applying the 1.5 percent deflator to the FY 2000 estimates for rental of ADP equipment, office equipment and other equipment, telephones and utilities.

Printing and reproduction.....	0	26
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GPO has provided an estimated rate increase of 3.3 percent. This percentage was applied to the FY 2000 estimate.

Other services	3	6,461
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Executive development and leadership training (\$220,000) - Consistent with the Department's SES 2000 plan, an increase of \$5,000 for each currently onboard SES position is required for Executive Development and Leadership Training. An increase of \$220,000 is requested.

Working Capital Fund (GA) (\$68,000) - An additional amount of \$68,000 is required to fund cost increases in the Departmental Working Capital Fund.

Financial Management System (\$4,422,000) - Under the current implementation scenario developed in conjunction with the Department, NIST would begin implementation of an integrated, financial management system in FY 2001, with full implementation achieved by the start of FY 2003. The Department has calculated NIST resource requirements for the implementation process based on relative financial

workload parameters with NOAA and Census. Based on these DoC estimates NIST will require an adjustment-to-base of \$4,422,000 in FY 2001.

National Archives and Records Administration (NARA) storage costs (-\$1,000) - In FY 2000, NARA will begin billing agencies for records storage and maintenance costs. The estimate for FY 2001 for STRS is a decrease of \$1,000.

Other Contracts/Services (\$558,000) - NIST is requesting \$558,000 to cover increased costs in other services. Other services include management and professional support services, training, maintenance of equipment, ADP services, purchases of goods and services from other Federal agencies, and research and development contracts. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate for other services (excluding payments to the GA Working Capital Fund).

Reactor License Renewal (4 positions, 3 FTE, \$600,000) - This adjustment covers the cost of additional staff, hardware and technical support required for renewing the operating license of NIST's research reactor before the Nuclear Regulatory Commission. The license renewal requires detailed technical analyses and the modernization of some reactor systems to meet current codes and standards.

NRC License Fees (\$1,076,000) - Recently, the Nuclear Regulatory Commission (NRC) established a ruling that would affect the fees imposed on several categories of NRC licensees. The ruling implements changes pursuant to the Omnibus Budget Reconciliation Act of 1990, which mandates that NRC collect from its licensees an amount equal to approximately 100 percent of NRC total budget authority less fees assessed. Prior to this ruling, NIST was not charged for NRC services. We estimate that these new NRC license services will cost \$1,076,250 in FY 2001.

Supplies and materials.....	0	248
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The \$248,000 increase was calculated by applying the deflator of 1.5 percent to the FY 2000 estimate for supplies and materials, exclusive of books and journals.

Equipment.....		0	332
Equipment amortization.....	227,000		
Office-ADP-Other equipment.....	105,000		
<p>Equipment amortization (\$227,000) - An increase of \$227,000 is required to offset the effects of inflation. The increase was based on applying the GDP price deflator of 1.5 percent to the FY 2000 STRS estimate for equipment amortization. The additional appropriated funds will be allocated to the NIST operating units to finance amortization charges paid to the NIST Working Capital Fund.</p> <p>Office-ADP-Other equipment (\$105,000) - The \$105,000 increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate for office machines, ADP, and other equipment.</p>			
Total, Adjustments to Base.....		2	16,230

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Electronics and electrical engineering

		1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
		Actual		Currently Available		Base		Estimate			
<u>Line Item</u>		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Electronics and electrical engineering	Pos./Approp	281	\$38,268	272	\$38,376	272	\$40,046	272	\$40,046	0	0
	FTE/Obl.	283	38,490	282	39,051	282	40,127	282	40,127	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Electronics and electrical engineering

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Electronics and electrical engineering										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>100</u>	<u>\$14,639</u>	<u>99</u>	<u>\$13,350</u>	<u>99</u>	<u>\$13,350</u>	<u>98</u>	<u>\$13,350</u>	<u>(1)</u>	<u>0</u>
Total	100	14,639	99	13,350	99	13,350	98	13,350	(1)	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
ELECTRONICS AND ELECTRICAL ENGINEERING

Goal Statement

The goal of this subactivity is to promote U.S. economic growth by providing high impact measurement capability focused primarily on the critical needs of the U.S. electronics and electrical industries, and their customers and suppliers. The subactivity strengthens the U.S. economy by enhancing the competitive position of these industries in domestic and international markets. The measurement capability takes the form of (1) documented high-performance measurement methods for electronic and related quantities, and (2) national reference standards and calibrations services that assure the consistency and accuracy of measurements across all users nationwide. This capability supports R&D and manufacturing leading to new and more competitive products and impacts product innovation, design, performance, reliability, maintainability, compatibility, and cost. This program also supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

Through the Electronics and Electrical Engineering Laboratory (EEEL) subactivity, NIST supports the U.S. electronics and electrical industries, their suppliers and their customers, including the U.S. Government, by providing the measurement capability that U.S. industry needs to improve its competitive position. That measurement capability takes the form of measurement methods, measurement reference standards to assure the accuracy of the methods, and measured materials reference data. This measurement capability provides the fundamental basis for all electrical measurements in the United States and supports industrial research and development toward new products, and the design and implementation of manufacturing processes of greater efficiency and quality. It facilitates marketplace transactions by supporting the specification of products by manufacturers and their customers, the proof of product performance needed by U.S. manufacturers to gain entry of their products in international markets, and facilitates the successful application of products after sale by supporting proper operation and maintenance. The scope of NIST's effort is reflected in the following sampling of the technologies and products benefitting: semiconductors and integrated circuits, including microwave integrated circuits; optoelectronics, photonics, and fiber optics; magnetic information storage; superconducting electronics and

magnets; computers and video equipment; satellite and other wireless communications; radar and navigation; electronic instrumentation; electric-power generating and transmission equipment; and electronic instrumentation broadly.

The measurement capability provided by this subactivity directly facilitates the success of industries of great importance to the U.S. economy. They include the electronics industry with shipments of \$467 billion in 1998,¹ the electric-power industry with shipments of \$218 billion of electricity in 1998,² and the electrical equipment industry with shipments above \$50 billion in 1999.³ The electronics industry alone employed nearly 2 million people at the end of 1998.⁴ The products of these industries, representing the better part of one trillion dollars in U.S. shipments annually, support other major manufacturing and service industries, such as the automotive, aerospace, and health-care industries. NIST provides measurement capability that supports the accuracy of the electric-power meters in every home and business in the United States, and the antenna measurement capability used by major U.S. aerospace manufacturers to make systems for satellite communications, navigation, aircraft collision-avoidance, weather monitoring, earth surveying, and many defense applications. NIST, through its National Semiconductor Metrology Program, provides the measurement capability identified in the *International Technology Roadmap for Semiconductors* as essential for the continued success of the semiconductor industry, which is key to the success of the electronics industry more broadly. NIST provides measurement capability used by manufacturers of optical fibers and lasers to assure their performance and compatibility in communications and other applications and measurement capability that supports advances in high-density magnetic information storage for computers and in path-breaking measurement reference standards based on superconducting technology.

In providing these measurement services, NIST does what individual companies cannot do: provide the measurement capability that assures the uniformity and accuracy of measurements throughout the entire U.S. economy. This measurement capability is implemented primarily through voluntary, documentary (written) standards created by U.S. industry itself. NIST's ability to succeed in this mission depends critically on its reputation for outstanding measurement expertise and for impartiality in dealing with U.S. companies and their customers. This combination of acknowledged expertise and impartiality enables NIST: to be trusted by industry with information about its measurement problems; to succeed in developing solutions to those measurement problems that can benefit industry as a whole; and to gain acceptance of those solutions by individual U.S. companies, by U.S. voluntary industry standards

¹1999 *Electronic Market Data Book: The Industry's Statistical Yearbook*, Electronic Industries Alliance, p. 2 (1999).

²*EI Statistical Year Book/1999*, Edison Electric Institute, p. 50 (1999).

³*Measurements for Competitiveness in Electronics*, National Institute of Standards and Technology, NISTIR 4583, p. 38 (1993). This industry surpassed \$48 billion in 1990 and has been growing since.

⁴1999 *Electronic Market Data Book: The Industry's Statistical Yearbook*, Electronic Industries Alliance, p. 1 (1999).

bodies, and by domestic and international customers of U.S. industry. All of these factors are critical to U.S. industry's efforts to realize more competitive products and to sell those products successfully in domestic and international markets.

The FY 2001 base program operating objectives include the following:

- Continue the critical evaluation and systematic characterization of the renovated watt-balance facility to establish the designed performance specifications. The projected overall experimental uncertainty of less than a part in 100 million represents an improvement of an order of magnitude over present capabilities. This major step will maintain NIST's position of world leadership in the development of an electronic system to monitor the present measurement reference standard for mass with an accuracy derived from fundamental physical constants of nature.
- Improve the accuracy of ac-voltage measurements by developing an ac-voltage source having a one-volt output based on the same fundamental physics of nature used to provide the measurement reference standard for dc voltage to support the improved accuracy of multifunction calibrators being developed by industry.
- Characterize the performance and stability of high precision optical current transformers (OCTs) for use by a deregulated electric power industry in monitoring bulk power transfers under an extensive range of operating conditions and environments, and develop calibration techniques and equipment to provide traceable 0.01 percent calibrations of OCTs.
- In response to the goals identified in the industry's *International Technology Roadmap for Semiconductors*, develop artifacts for certifying electrical linewidth of single-crystal Critical Dimension (CD) reference materials using direct imaging of silicon lattice planes, and provide technical and traceability support for domestic commercial production and distribution of a CD reference material to be used in the calibration of metrology tools to support the 90 nm generation of lithography for integrated circuits.
- Develop improved measurements for making insulating layers for ever-smaller transistors in integrated circuits and for identifying better insulating materials as thin as 2 nm, study breakdown characteristics and failure modes, and develop the physics-based reliability models critically needed by the semiconductor industry and their customers for determining the reliability of advanced insulating films.
- Develop new measurement techniques, instruments, and standards to permit improved efficiency in the manufacture of compound semiconductor devices. Such devices, including lasers and detectors, are crucial for a wide range of technologies and markets including optical telecommunications, the internet, and data storage for computers and entertainment. Specific requirements are

(1) improved non-contact temperature measurements in a high vacuum environment; (2) methods of monitoring starting material purity to 100 parts per trillion resolution; and (3) artifact material composition standards.

- In response to specific industry requests, develop and provide new measurement technology and services to support dramatic increases in the speed and capacity of optical communication systems, including standard reference materials to support accurate measurements of wavelength of light in the 1,300 nm to 1,580 nm region, polarization-dependent loss, and new calibration services to support the specification of optical fiber amplifiers.
- Provide industry-invited technical input for developing video electronics standard on flat-panel displays and develop measurements for display parameters that better reflect the way a human eye views a display.
- In response to an industry need for smaller and faster integrated circuits for advanced microprocessors and other devices, develop new measurement techniques for characterizing nonlinear devices on-wafer, and use these measurements to validate computer aided design and circuit simulation methods commonly used by industry for design and modeling of nonlinear devices.
- Collaborate with the U.S. magnetic data storage/recording industry to develop methods for measuring the switching time of magnetic domains and key techniques for characterizing ultra-small structures through visual images, noise measurements, and determination of long-term reliability. These test methods and measurement services will help the magnetic data storage/recording industry develop new manufacturing processes, keep pace with improvements in the density of data storage, and maintain its lead in world markets.
- Support business use of electronic commerce to improve design and development processes for electronic products by developing and disseminating a software translator that will convert a company's internal dictionary of product terminology into the industry-standard Component Information Dictionary. A standard format is needed so that engineers and designers can compare products from two or more suppliers and to check the compatibility of selected products intended to work together.
- Advance national interest in the development of international electromagnetic compatibility (EMC) conformity standards by providing closely-coupled theoretical and experimental technical support for industry and representation on international normative standards committees to facilitate the adoption of technically-sound and cost-effective test methods that are favorable to U.S. industry.

Performance Measures
(All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the General Statement.

The NRC Assessment Panel for EEEL met on February 10-12, 1999, and has provided the following findings: "...The technical activities under way in the EEEL are producing important results that have significant impacts on relevant industries. Given that the laboratory's mission to provide measurement capabilities for the U.S. electronics and electrical industries is very broad, EEEL management must make careful decisions about how to best utilize the limited resources available to NIST. The panel applauds the laboratory's historically verified ability to select specific areas for focused activities with carefully targeted impacts." The full report of the Panel's findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: <http://www.nap.edu/books/NI000763/html>.

The NRC Assessment Panel for the Electronics and Electrical Engineering Laboratory will meet again on February 17-18, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratory's facilities, equipment, and human resources.

Along with peer-review evaluations, the Electronics and Electrical Engineering Laboratory, in cooperation with the NIST Office of Strategic Planning and Economic Analysis, has begun a new, more comprehensive series of economic impact studies. The first of the studies completed for this subactivity addressed semiconductor power device modeling. It found that NIST had had a significant impact on industrial development of modeling tools with concomitant benefits to products employing the resulting devices, such as automobile ignition systems and appliances. The estimated annual internal rate of return was 76 percent, and the benefit-to-cost ratio was 23 to 1. Present value of net benefits was \$10 million.⁵

⁵*Benefit Analysis of IGBT Power Device Simulation Modeling*, 99-3 Planning Report, Research Triangle Institute, p. ES-2 (1999)

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Electronics and Electrical Engineering
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY 2001 <u>Estimate</u>
Department of Defense			
Air Force	\$1,295	\$1,295	\$1,295
Army	262	262	262
Navy	970	970	970
Other	<u>700</u>	<u>700</u>	<u>700</u>
Subtotal, Department of Defense	3,227	3,227	3,227
Department of Commerce	29	0	0
Department of Energy	646	350	350
Department of Justice	5,419	4,000	4,000
Department of Transportation	166	100	100
National Aeronautics & Space Administration	1,158	1,400	1,400
National Science Foundation	0	200	200
Other	<u>21</u>	<u>21</u>	<u>21</u>
Total, Other Agency	10,666	9,298	9,298
Calibrations & Testing	1,799	1,800	1,800
Standard Reference Materials	83	152	152
Technical & Advisory Services	2,091	2,100	2,100
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>0</u>
Total, Other Reimbursables	3,973	4,052	4,052
Grand Total, Reimbursable Program	14,639	13,350	13,350

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Manufacturing engineering

		1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
		Actual		Currently Available		Base		Estimate			
<u>Line Item</u>		<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>
		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>	
Manufacturing engineering	Pos./Approp	146	\$19,281	140	\$19,057	140	\$19,782	156	\$23,782	16	\$4,000
	FTE/Obl.	147	19,123	144	19,299	144	19,821	156	23,571	12	3,750

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
 (Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Manufacturing engineering

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Manufacturing engineering										
Direct obligations		0		0		0		\$250		\$250
Reimbursable FTE/Obl	<u>50</u>	<u>\$6,182</u>	<u>51</u>	<u>\$6,034</u>	<u>51</u>	<u>\$5,938</u>	<u>51</u>	<u>5,938</u>	<u>0</u>	<u>0</u>
Total	50	6,182	51	6,034	51	5,938	51	6,188	0	250

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
MANUFACTURING ENGINEERING

Goal Statement

The goals of this subactivity are to (1) provide measurements, calibrations, and quality assurance techniques that underpin U.S. commerce, technological progress, product reliability, and manufacturing productivity, and (2) enhance the competitiveness of U.S. industry by providing appropriate support for the measurements, standards, and infrastructure technology that are crucial to industry's success in exploiting advanced manufacturing technology. The Manufacturing Engineering subactivity achieves these goals by conducting research in the areas of high-precision dimensional measurements for precision-engineered systems; measurements and interface standards for automated production technology; standards and open-system architectures for intelligent manufacturing systems; and interoperability standards, information models, and frameworks for integrating manufacturing systems. In addition, this subactivity provides technical support for joint industry committees that are developing voluntary standards for length, force, mass, acceleration, other related physical quantities, and standards for the electronic representation and exchange of product and process information. An active program of technology transfer to industry is achieved through cooperative research, industrial research associates, publications, conferences, seminars, and workshops. This program also supports the DoC strategic goals to stimulate innovation for competitiveness.

Base Program

Through this subactivity, carried out in the Manufacturing Engineering Laboratory, NIST provides measurement methods, calibration standards, and a technical research base for standards that facilitate interoperable manufacturing systems. These measurements, standards, and infrastructure technologies accelerate the insertion of advanced manufacturing technologies into manufacturing systems and improve on-line quality assurance processes that enable mechanical manufacturing industries to adopt advanced manufacturing technologies more quickly. The mechanical manufacturing industries served by this program comprise approximately one-third of the total contribution to the GNP by the manufacturing sector and include the automotive, commercial aircraft, consumer electronics, and

machine tool industries. However, this group of manufacturing industries also faces especially intense global competition. Nearly half the total U.S. trade deficit results from imbalances in trade in mechanical products, indicating that international mechanical manufacturing industries currently have a significant competitive advantage over U.S. counterparts. NIST is well-positioned to provide the measurement and standards support to help U.S. mechanical manufacturing industries adopt advanced manufacturing techniques to improve their competitive position.

To remain competitive in today's global manufacturing environment, manufacturers must constantly improve. NIST supplies U.S. industry with the standards and measurement methods that support process control and accurate inspection techniques that increase precision, quality, productivity, and cost efficiency. As the global market demands ever higher quality, U.S. industries depend upon NIST for calibration services that assure dimensional compatibility of items manufactured at different sites and that satisfy requirements for traceability to national standards. NIST aids the manufacturing community by providing the measurement tests, tools, and calibrations that are essential for controlling manufacturing processes accurately, with high precision and high quality. NIST also provides a technical research base to support ever-tightening geometric tolerances, more sophisticated product descriptions, and advanced intelligent processes.

The FY 2001 base program operating objectives include the following:

- Define foundational technologies and standards that enable creation of flexible testbeds for manufacturing simulations, focusing specifically on generic software engineering tools for creating simulation nodes with a scalable enterprise-wide architecture, and knowledge representation for products and for intelligent and science-based unit processes.
- Define languages, visualization techniques, data models, machine dynamic response models, and testing methodologies for representing and visualizing manufacturing systems and their components. Work with manufacturers' simulation software vendors, standards organizations, and the research community to advance the science and application of manufacturing simulation and virtual technologies.
- Develop, as an International Organization for Standardization (ISO) standard, a neutral specification for the representation and exchange of manufacturing process data to complement the successful international deployment of ISO 10303 for the exchange of product model data.
- Support the next-generation product-engineering environment by developing interface standards for knowledge-based design and assembly representation, and validate these standards in pilot implementations in partnership with industry.

- Improve, in cooperation with industry, the speed and accuracy of geometric and dimensional measurements of manufactured parts through the use of vision, proximity sensors, and touch probes on coordinate measuring systems (CMSs). Develop rigorous testing of surface fitting algorithms, and open architecture interface standards for such multi-modal measuring machines. Benefits include higher speed and lower cost inspections.
- Develop concepts, methods, and supporting measurement capabilities to address new U.S. manufacturing industry needs for making high-accuracy measurements in industrial environments with statements of measurement uncertainties to meet requirements of international trade.
- Develop and disseminate atom-based dimensional standards and associated measurement procedures to the semiconductor and data storage industries to support industry R&D and fabrication of next-generation micro- and nano-electronic devices.
- Further develop parallel machine tool performance parameters and characterization techniques that are suitable for standardization proposals to be submitted to American National Standards Institute/American Society of Mechanical Engineers Committee B5. This standard will help U.S. manufacturing companies to evaluate and use this new class of machine tool.
- For all mechanical metrology measurement services, complete an evaluation of our customer needs through workshops and surveys. Improve delivery of measurement services through implementation of quality management systems and standardized databases for tracking calibration requests.
- Develop improved methods for manufacturing process metrology and modeling, including: tuning algorithms for machine tool models based on post-process inspection analysis and verification; comparing analytical models of material removal mechanisms with experiments and finite element models for orthogonal metal cutting; and applying polymer-based acoustic emission sensors to correlate wheel-grinder wear to grinding wheel-part conditions.

Performance Measures
(All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the General Statement.

The NRC Assessment Panel for MEL met on February 24-25, 1999, and has provided the following findings: “Overall the laboratory continues to make significant technical progress and to contribute substantially to the manufacturing industries. Benchmarking exercises have shown that much of the MEL’s work is among the best in the world. Programs and projects being pursued are supportive of both the MEL and the NIST missions, and the laboratory has made good progress in developing criteria for program prioritization. Continued effort will result in even more appropriate criteria and in their application in all MEL divisions.” The full report of the Panel’s findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: <http://www.nap.edu/books/NI000763/html>.

The NRC Assessment Panel for the Manufacturing Engineering Laboratory will meet again on March 14-15, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratory’s facilities, equipment, and human resources.

The work performed by MEL in establishing the STEP standard (ISO 10303) has led to several cases of significant savings. For example, Lockheed Martin’s F-22 program shows consistent savings using STEP: 50 percent process savings for composites and 27 percent projected savings on tool design with CAD/CAM systems.¹ The Boeing C-17 program reduced time to transfer bill of material data from months/weeks to overnight using STEP,² and found a 75 percent time savings in processing designs from engine suppliers for its 767 and 777 programs.³ Prior economic impact studies of MEL programs, “An Economic Evaluation of NIST’s Research in Real-time Control System (RCS) Architecture, 1995”⁴ and “The Economic Impacts of NIST’s Software Error Compensation (SEC)

¹ See website at: http://pdesinc.scra.org/whatsnew/lockmart_press.html

² See website at: <http://pdesinc.aticorp.org/pilots/cstar.html>

³ STEP: A Global Standard for Global Industries (Video, 1998, available from PDES, Inc. –<http://pdesinc.scra.org/>)

⁴ Leech, David and Albert N. Link, An Economic Evaluation of NIST’s Research in Real-Time Control System (RCS) Architecture: A Case Study Approach (Planning Report 95-2). National Institute of Standards and Technology, 1995.

Research, 1996”⁵, estimated internal rates of return of 149 percent and 99 percent, respectively. The fundamental research done in real-time control system architecture in MEL was shown to have a significant impact on the mining industry with quantifiable benefits due to expedited use of automation, reduced injury rates, and increased coal mining productivity. As a result of MEL’s SEC research, the eventual cost of commercial R&D efforts was reduced, and the adoption and diffusion of SEC technology were accelerated with quantifiable benefits to manufacturers due to increased productivity.

In addition to retrospective impact studies, the Manufacturing Engineering Laboratory recently completed a planning study that estimated the economic costs of inadequate software interoperability in the automotive supply chain to be in excess of \$1 billion/year. MEL currently is involved in developing standards that promote interoperability among members of the U.S. automotive supply chains. By understanding the sources and magnitude of inefficiencies caused by interoperability problems, NIST can better determine the potential impact of its programs and focus them to maximize program effectiveness.

⁵ Leech, David and Albert N. Link, The Economic Impacts of NIST’s Software Error Compensation Research (Planning Report 96-2), National Institute of Standards and Technology, 1996.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

		2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Manufacturing engineering	Pos./Approp	140	\$19,782	156	\$23,782	16	\$4,000
	FTE/Obl.	144	19,821	156	23,571	12	3,750

Manufacturing interoperability (+16 Permanent Positions, +12 FTE, BA +\$4,000,000, Direct Obligations +\$3,750,000, Transfer to WCF +\$250,000) – To improve U.S. manufacturing productivity by ensuring that electronic data can be exchanged accurately and efficiently. Imperfect interoperability—barriers to communicating electronic data between manufacturers, in supply chains, and within enterprises—imposes a cost of at least \$1 billion per year on the automotive supply chain, and is estimated to annually cost the aerospace, farm and construction equipment, and ship building industries as much as \$400 million per year.¹ NIST will work with industry to develop the enabling standards, technologies and measurements infrastructure to facilitate interoperability. NIST will address the interoperability problem by: catalyzing the development of standards for manufacturing interoperability; developing software interoperability conformance testing metrics, tools, and methods; and establishing a software interoperability testbed. This work supports the DoC strategic goals to promote economic growth, stimulate innovation for competitiveness, and advance sustainable economic development. This work also supports the DoC Secretarial priority on Accelerating the Transition to Electronic Commerce.

¹ Interoperability Cost Analysis of the U.S. Automotive Supply Chain, Planning Report 99-1, Research Triangle Institute for the NIST Strategic Planning and Economic Analysis Group (March 1999).

Problem Magnitude and NIST Role:

Business-to-business e-commerce will become a necessity for businesses to compete in the modern world. Information technology and the internet are rapidly changing the marketplace, but not all U.S. firms are positioned to competitively participate.

While many vendors offer e-business products, these products are not designed to work together. Business-to-business e-commerce is an especially complex problem requiring a broad range of voluntary interoperability standards which either do not exist today or do not work together cohesively. Over 100 e-commerce-related standards are currently under development to partially address this need; this plethora of choices threatens to fragment the marketplace with incompatible and competing standards. NIST leadership and technical expertise are needed to harmonize standards and provide the infrastructure required for continued U.S. preeminence in e-commerce.

While e-commerce holds great promise, many of its benefits can remain unrealized in the absence of standards and technology that provide ease of communication within and among business partners and across multiple Information Technology (IT) platforms. According to IPC-The Association Connecting Electronics Industries, hundreds of millions of dollars are lost each year by North American electronics manufacturers due to inefficient data exchange technologies and consequent lost market opportunities. Ultimately, this initiative seeks to lower these costs and improve supply chain efficiency by providing a broader and more optimal set of infrastructural standards and technologies than are currently available.

In an attempt to become more globally competitive, the major players in U.S. industry are restructuring to cut costs and speed product development. They are increasingly focusing on parts and services in which they possess a clear competitive advantage and outsourcing other work. This outsourcing is an opportunity for a myriad of small- and medium-sized businesses, an opportunity only if these businesses can economically and accurately exchange business and product data with their supply chain partners. In the absence of software interoperability, small- and medium-sized businesses must purchase and maintain multiple design systems or invest in expansive translation software. By 2003, it is estimated that 137 million business users will be involved in remote work of some kind.² Industry sources indicate that Fortune 500 companies already outsource 78 percent of their transportation, 54 percent of their distribution, and 46 percent of their manufacturing.³ These numbers are expected to increase, with the third-party logistics industry expected to double to \$50 billion in the next two years.⁴

² Key Issues in Mobile and Remote Middleware, K. Scherberger, Gartner Group (April 24, 1998).

³ Internet Collaboration Gets Another Tool, Technical Insights Alert, John Wiley & Sons (June 11, 1999).

⁴ Ibid.

Modern manufacturing systems require intensive exchange of product information during the design and development process. This relatively new manufacturing way of doing business, called concurrent engineering, integrates design, manufacturing and support processes and is credited with reducing the design and development process for a new U.S. automobile from 60 months or more to as little as 24 months. Concurrent engineering requires accurate and efficient information exchange that depends critically on the software interoperability.

Nevertheless, industry is often reluctant to invest in infratechnologies – such as interoperability standards and software. One reason is that it is impossible to exclude those that do not pay for infratechnologies from benefiting from them. Because industry as a whole would benefit from improved interoperability standards, no *individual* firm has the incentive to invest substantial resources to develop and promote the standard. Another reason for underinvestment in infratechnologies is the inherent technical and market risk. NIST can address these market failures by catalyzing the development of interoperability standards and reducing the risk by providing the unbiased expertise that the standards development process needs, which include test methods, tools and testbeds.

Business use of internet technologies continues to grow and there are numerous credible forecasts that business-to-business electronic commerce will yield tremendous economic benefits for our nation. However, in order to realize these benefits, software interoperability problems must be solved. It is crucial to solve these incompatibilities in a way that assures the competitiveness of our economy in international marketplaces and simultaneously sustains our nation's technical leadership in information technology.

NIST's role will be a natural extension of its traditional role of providing the standards and measurement technologies. In this case, the standards and measurement technologies will allow businesses to accurately determine whether information technology components function as specified and whether they fit together as intended. NIST continues to have a distinguished role in a key piece of the interoperability puzzle—STEP, a standard for the exchange of product model data. Recently NIST became involved in RossettaNet, a business-to-business e-commerce consortium for the exchange of business and product data for the computer and electronics parts industries.

Among the Federal laboratories, only NIST has the mission to strengthen the U.S. economy by working with industry to develop and apply technology, measurements, and standards, along with the necessary combination of staff expertise, industry contacts, and worldwide recognition as the leading measurement and standards institution to accomplish that task.

Proposed NIST Technical Program:

With the proposed funding level, NIST will accelerate the development of the standards and technology infrastructure needed to support interoperability solutions for e-commerce, in particular in the manufacturing domain. This initiative will help businesses large and small, up and down the supply chain.

In this initiative, NIST will work with businesses to codify voluntary agreements specifying the meaning of the business and product data in our major manufacturing industries. This is not "a one size fits all" approach—industries all have specialized vocabularies which must be formalized to everyone's satisfaction. Building on the strong relationships NIST already has with numerous industries, NIST will provide the objectivity necessary to build consensus and harmonize existing efforts with new emerging standards. Utilizing its internationally recognized measurement and testing expertise, NIST will develop the new measurement technologies required for businesses to determine how well their, or their partner's software systems implement interoperability solutions, whether in this country or another's.

The emergence of a pervasive e-commerce economy depends strongly on the development of enabling information technologies that provide efficient, reliable, and economical methods for conducting business processes electronically. Many infrastructure technologies are already being deployed to support a wide range of business activities on the Internet. Yet, most of these applications are autonomous, using various technologies that do not fully support business requirements for interoperability. Although some major vendors and business organizations are actively developing solutions focused on their specific industries or target markets, the larger business and technical community has not yet established an agreed upon framework for conducting open and interoperable e-commerce. Under this initiative, NIST will apply its technical resources and worldwide reputation for excellence and impartiality to the difficult problem of testing interoperability of these emerging frameworks, standards, and infrastructure at the international level.

NIST will collaborate with industry to identify, develop, test, and evaluate advanced and critical standards needed for interoperability infrastructure services and capabilities. Pilot projects will test and demonstrate key enabling technologies, their integration and interoperability and their conformance to public specifications. Results from NIST-industry collaborations under this task will provide evidence of feasible interoperability solutions, identify important technologies, promote specification and adoption of open standards, and provide improved testing methods and tools.

The initiative consists of the following components:

- Develop standards for manufacturing software interoperability;
- Develop conformance testing tools, metrics and methods for interoperability software; and
- Establish a manufacturing software interoperability testbed.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Electronic Commerce Initiative – Interoperability	
Technical Area	Outputs
Develop Standards for Interoperability of Manufacturing Software with Industry	<ul style="list-style-type: none">• Develop three new core standards with wide industry sector applicability within five years.
Conformance Testing Development	<ul style="list-style-type: none">• Develop or specify three performance metrics or measurement methods within two years.• Develop or specify two conformance testing tools within three years.
Interoperability Testbed	<ul style="list-style-type: none">• Develop a prototype testbed for interoperability testing within two years.• Establish a national interoperability testbed, and document industry utilization within four years.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- Promote the efficiency and interoperability in product data exchange for multiple industries and industry segments, including but not limited to, automotive and other discrete parts manufacturing industries;
- Increase the number of small- and medium-sized manufacturing businesses participating in business-to-business e-commerce and participating in national and international supply chains;
- Reduce costs to industry resulting from multiple redundant software systems and errors in product data exchange;

- Bring products to the market more quickly due to concurrent engineering schemes that depend on intensive product data exchange;
- Lower the substantial cost to industry of supply chain inefficiency due to interoperability – for example the \$1 billion cost of this inefficiency to the automotive industry; and
- Improve productivity throughout the economy, including virtually all manufacturing industries, as well as defense and many other government applications.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Manufacturing engineering

Program Change: Manufacturing interoperability

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer scientist	ZP V	1	84,530	84,530
Mechanical engineer	ZP V	1	84,530	84,530
Computer scientist	ZP IV	5	71,861	359,305
Electrical engineer	ZP IV	2	71,861	143,722
General engineer	ZP IV	1	71,861	71,861
Mechanical engineer	ZP IV	2	71,861	143,722
Physical scientist	ZP IV	3	71,861	215,583
Administrative/technical support	ZA II	1	35,265	35,265
Subtotal		<u>16</u>		<u>1,138,518</u>
Less lapse	25 %	(4)		(284,630)
Total full-time permanent (FTE)		<u>12</u>		<u>853,888</u>
2001 Pay Adjustment (3.7%)				31,594
Total				<u>885,482</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		12		
Authorized Positions:				
Full-time permanent		16		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Manufacturing engineering

Program Change: Manufacturing interoperability

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$885
11.9 Total personnel compensation	885
12.1 Civilian personnel benefits	216
21 Travel and transportation of persons	126
22 Transportation of things	35
23.3 Communications, utilities and miscellaneous charges	202
24 Printing and reproduction	8
25.1 Advisory and assistance services	0
25.2 Other services	1,324
25.3 Purchases of goods and services from Government accounts	431
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	75
26 Supplies and materials	404
31 Equipment	44
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 3,750
Transfer to NIST Working Capital Fund	250
Total increase requested	<hr/> 4,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Manufacturing Engineering
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Department of Defense			
Air Force	\$315	\$300	\$301
Army	1,365	2,000	2,100
Navy	341	250	263
Other	<u>1,080</u>	<u>600</u>	<u>630</u>
Subtotal, Department of Defense	3,101	3,150	3,294
 Department of Veterans Affairs	 191	 190	 200
General Services Administration	591	350	50
National Aeronautics & Space Administration	43	0	0
National Science Foundation	<u>43</u>	<u>50</u>	<u>50</u>
Total, Other Agency	3,969	3,740	3,594
 Calibrations & Testing	 1,324	 1,400	 1,450
Standard Reference Materials	137	144	144
Technical & Advisory Services	752	750	750
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>250</u>
Total, Other Reimbursables	2,213	2,294	2,594
 Grand Total, Reimbursable Program	 6,182	 6,034	 6,188

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Chemical science and technology

			1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
			Actual		Currently Available		Base		Estimate			
			Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount
<u>Line Item</u> Chemical science and technology	Pos./Approp		232	\$32,327	225	\$32,117	225	\$33,295	225	\$33,295	0	0
	FTE/Obl.		234	31,991	232	32,481	232	33,360	232	33,360	0	0

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
 (Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Chemical science and technology

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Chemical science and technology										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>116</u>	<u>\$14,782</u>	<u>117</u>	<u>\$15,197</u>	<u>117</u>	<u>\$15,664</u>	<u>117</u>	<u>\$15,664</u>	<u>0</u>	<u>0</u>
Total	116	14,782	117	15,197	117	15,664	117	15,664	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
CHEMICAL SCIENCE AND TECHNOLOGY

Goal Statement

The goals of this subactivity are to (1) provide chemical measurement research, standards, data, and calibrations that underpin United States commerce, technological progress, improved product reliability, quality assurance, and manufacturing processes, and (2) enhance the competitiveness of American industry by providing appropriate infrastructural measurement support for industry's development of broad-based technologies which promise substantial commercial application and diffusing these scientific advances to users in all segments of the American economy. This program also supports the DoC strategic goal to stimulate innovation for competitiveness.

The Chemical Science and Technology subactivity achieves these goals by conducting fundamental investigations on measurement-based phenomena related to the composition, structure, properties, and behavior of chemical and biochemical systems, while developing and improving measurement capability and quantitative understanding of the underlying physical principles of measurement science. The program is built around several continuous activities which are designed to identify and address industry's most pressing needs and transfer NIST-developed science and technology to industry quickly and effectively, utilizing collaborative research programs, memberships in voluntary standards organizations, professional societies and trade associations, publications, patents, conferences, seminars, workshops, and CRADAs (Cooperative R&D Agreements).

Base Program

NIST's Chemical Science and Technology Laboratory (CSTL) serves as the Nation's primary reference laboratory for chemical, biochemical and chemical engineering measurements by providing the underlying scientific and engineering measurements, standards, data on key properties (thermophysical, thermochemical, and kinetic), predictive methods, modeling, and calibration and measurement services. NIST activities benefit the chemical, semiconductor, energy, clinical, automotive, biotechnology, food and nutrition, and materials-processing industries. NIST assists these industries in introducing competitive technology in the marketplace and also provides advances in chemical measurement science to address the needs of new high technology industries through such efforts as developing advanced

measurement methods and reference materials for high accuracy chemical analyses; providing the national standards for measurements of temperature, pressure, vacuum, leak rate, fluid flow, humidity, liquid density, volume, and air speed; and performing research on the structure and behavior of atoms and molecules in isolation, in clusters, and on surfaces. In addition, the measurement methods, data, and reference materials from CSTL provide the basis for uniform measurements in the chemical and biochemical processing, semiconductor manufacturing, medical testing, public health and safety, instrument manufacturing, metals-producing, and emerging high technology materials industries, as well as many Federal programs, filling the basic need for national traceability and international comparability of chemical, chemical engineering and biochemical measurements used in commerce and science.

The diversity and nature of the required measurement science and technology and the scope and sizes of the industrial and public sectors involved are such that no single commercial organization has an economic incentive to produce, maintain, and interrelate the measurement methods and reference data and materials, and to support the necessary measurement and standards infrastructure. Measurement-related problems and barriers to technology development encountered by U.S. industry are addressed by NIST as the Nation's lead agency for measurement, extending both its expertise and its impartiality relative to sellers and buyers for the benefit of all.

The FY 2001 base program includes new and enhanced operating objectives in advanced measurements, standards and data for chemical processes, the biosciences, health, and environment. These objectives include the following:

- Develop global intercomparability for chemical measurements by: 1) conducting international comparisons for the determination of clinically significant constituents in blood; 2) conducting international studies focused on evaluating the scope, applicability, limitations, and appropriate use of various approaches/techniques used to assess the purity/stoichiometry of organic/inorganic compounds; and 3) establishing a pilot effort for the development of gas mixture certified reference materials through collaboration with other leading national metrology institutes. These activities will initiate the establishment of an international comparability structure for measurements in chemistry and are instrumental in removing trade barriers to international trade.
- Provide traceability for commercial producers of spectrometric solution reference materials through extension of the NIST Traceable Reference Material (NTRM) Program. The objectives include: 1) identifying protocols for value assignment of benchmark materials, to be jointly chosen and produced with the secondary laboratory; and, 2) developing advanced spectroscopic and x-ray analytical methods to underpin the accuracy of Standard Reference Material (SRM) and NTRM certification. These activities will provide U.S. industry with a national traceability system that will greatly improve quality assurance.
- Implement a quality systems approach for the calibration services provided by CSTL that unifies scientific excellence with a well-documented, customer-responsive process to ensure clarity in key policies and procedures based on best practices, while ensuring

conformance with the internationally recognized guidelines and standards (ANSI/NCSL Z540-1-1994 and ISO 9001) for calibration laboratories.

- Establish a focused bioinformatics program to meet the data and measurement information needs of the rapidly emerging biotechnology industries. A primary activity will be in the advanced development of the National Science Foundation/Department of Energy/National Institute of Health's Protein Data Bank (PDB) at NIST under the auspices of the Research Collaboratory for Structural Bioinformatics, a joint undertaking of NIST, Rutgers University and the University of California-San Diego. This reflects the importance of biomolecular structures in the future development of biotechnology, particularly in pharmaceutical development and biomanufacturing.
- Develop evaluated benchmark data, data prediction methods, and models for the properties of important substances and systems by: 1) improving the mixture models in conjunction with projects on natural gas systems and refrigerants to expand the utility and functionality of the NIST Thermophysical Properties of Pure Fluids Database; and 2) expanding the utility of the Chemical Kinetics Database by developing new calculational tools for evaluating data on pressure-dependent rate constants. These projects will assure U.S. industry access to accurate and reliable data and predictive models to determine the chemical and physical properties of materials and develop new processes.
- Develop measurement and modeling techniques for characterizing enzymatic transformations that are important to industrial applications of biocatalysis and metabolic engineering. The biosynthetic pathway leading from glucose to chorismate, which has major industrial potential, will be used as a model system for these investigations.

Performance Measures (All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the General Statement.

The NRC Assessment Panel for CSTL met on March 2-3, 1999, and has provided the following findings: "The technical work of the CSTL provides high-quality chemical measurement capabilities and state-of-the-art basic and applied research in a broad range of technical areas. In conformance with the NIST mission, the laboratory maintains an array of programs that foster development of the essential measurement standards and technologies for both current and future technical needs of U.S. industry. The breadth of scientific research and expertise in CSTL reflects the range of customers that benefit from the laboratory's work—encompassing the newer semiconductor, aerospace, and

biotechnology industries as well as the more mature chemical processing, health, and energy-related industries.” The full report of the Panel’s findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: <http://www.nap.edu/books/NI000763.html>.

The NRC Assessment Panel for the Chemical Science and Technology Laboratory will meet again on February 29 – March. 1, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratory’s facilities, equipment, and human resources.

Economic impact studies of CSTL programs in calibrations (temperature measurement using thermocouples) and data evaluation (thermochemical and physicochemical properties of alternative refrigerants) have been conducted. Results from the study on calibrations indicate a social rate of return of 32 percent and a benefit-cost ratio of four to one. Results from the study on data evaluation indicate a social rate of return of 433 percent and a benefit-cost ratio of four to one. A study to assess the economic impacts of cholesterol standard reference materials began in FY 1997 and will be completed in early FY 2000. Economic impact assessment studies of sulfur measurements in fossil fuels and of DNA diagnostic reference materials have been initiated in FY 1999.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Chemical Science and Technology
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY 2001 <u>Estimate</u>
Department of Defense			
Air Force	\$3,935	\$4,200	\$4,326
Army	214	100	103
Navy	257	141	146
Other	<u>1,548</u>	<u>815</u>	<u>840</u>
Subtotal, Department of Defense	5,954	5,256	5,415
Department of Commerce	148	207	214
Department of Energy	1,893	1,800	1,860
Department of Health & Human Services	49	0	0
Department of the Interior	69	10	13
Department of Justice	75	843	868
Environmental Protection Agency	764	858	884
General Services Administration	20	60	62
National Aeronautics & Space Administration	587	515	531
National Science Foundation	<u>4</u>	<u>60</u>	<u>62</u>
Total, Other Agency	9,563	9,609	9,909
Calibrations & Testing	1,709	1,826	1,881
Standard Reference Materials	2,426	2,513	2,588
Technical & Advisory Services	1,084	1,249	1,286
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>0</u>
Total, Other Reimbursables	5,219	5,588	5,755
Grand Total, Reimbursable Program	14,782	15,197	15,664

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Physics

<u>Line Item</u>	1999		2000		2001		2001		Increase/ (Decrease)	
	Actual		Currently		Base		Estimate		Over 2001 Base	
	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>
	<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>	
Pos./Approp	171	\$28,290	164	\$28,423	164	\$29,454	180	\$39,454	16	\$10,000
FTE/Obl.	172	29,051	169	28,778	169	29,556	181	37,756	12	8,200

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Physics

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Physics										
Direct obligations		0		0		0		\$1,800		\$1,800
Reimbursable FTE/Obl	<u>67</u>	<u>\$13,401</u>	<u>68</u>	<u>\$13,468</u>	<u>68</u>	<u>\$13,551</u>	<u>68</u>	<u>13,551</u>	<u>0</u>	<u>0</u>
Total	67	13,401	68	13,468	68	13,551	68	15,351	0	1,800

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
PHYSICS PROGRAM

Goal Statement

The goals of this subactivity are to (1) enhance the competitiveness of American industry by providing measurement support for industry's development and commercialization of appropriate broad-based technologies and diffusing these advances to users in all segments of the American economy, and (2) provide measurements, calibrations, and quality assurance techniques that underpin U.S. commerce, technological progress, improved product reliability, and manufacturing processes. The program transfers physical standards, measurement methods, and data to the technical community through collaborations, visiting scientist programs, measurement services, workshops, training courses, participation on standards and other technical committees, publications, seminars, and Cooperative R&D Agreements (CRADAs). This work supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

The NIST Physics program supports U.S. industry by providing measurement services and research for optical, electronic, magnetic, and radiation technologies. The program strives to meet existing and emerging physical measurement needs and to conduct underpinning research to develop new measurement science and technology. Measurement services span five major areas: measurement of optical radiation and optical properties of materials; atomic, molecular, and radiation data; time and frequency standards and dissemination; ionizing and neutron radiation measurements; and magnetic and electronic measurement techniques.

The Physics program develops and disseminates national standards for measurement of optical radiation and optical properties of materials for manufacturing process controls and for applications in the optical instrumentation, imaging, lighting, optoelectronics, aerospace, and semiconductor industries, and in other industries where product appearance, color, and visibility are important. The program maintains unique facilities to measure the performance of optical sensors, to provide standard reference materials for various

optical properties, to remotely measure temperature using optical and infrared radiation, to develop high performance optical radiation sources and measurement technology, and to conduct research to develop new measurement standards and techniques.

The Physics program generates, evaluates, compiles, and disseminates fundamental data on the properties of atoms, molecules, and radiation. Such data are critically needed in such national industries and programs as environmental monitoring and remediation, energy efficiency improvement for vehicles and appliances, efficiency and safety improvement in conventional and nuclear power generation, lighting efficiency improvement, health care, microelectronics, defense, and space research. The program develops new ways to efficiently disseminate the data through software packages, freely-accessible interactive databases on the Internet, and traditional publications.

The Physics program develops and disseminates official national standards for time and frequency to meet critical industrial needs, including timestamping of electronic financial transactions, telecommunications, electric power transmission, transportation, navigation and positioning (including support of the Global Positioning System), and various defense applications. The program develops new time dissemination methods using the Internet and radio broadcasting for industrial, consumer, government, and scientific applications, which serve several million customers daily. The program conducts ground-breaking research to develop new time and frequency standards based on laser cooling and trapping of atoms and ions.

The Physics program develops and disseminates national standards and measurement techniques for ionizing and neutron radiation applications in support of the health care industry, measurement and remediation of environmental radiation, radiation processing of food and materials, nuclear power generation, and radiographic imaging for non-destructive evaluation. The program conducts research to develop new techniques for improved radiation measurements for industry and for health, environmental, and scientific applications.

The Physics program develops new methods for measuring electronic and magnetic properties of nanostructures on an atom by atom basis, primarily in support of the semiconductor and magnetic storage industries. The program conducts research to develop new measurement science in support of trends in the electronics and computer industries for greater efficiency in storing, retrieving, and processing information.

The Physics program balances state-of-the-art measurement services with an appropriate level of high-risk research and development of new measurement science needed to enable continued technical innovation in U.S. high technology industries. The program plays a unique role in national high technology development, since industry and academic institutions are unable to provide the financial and human resources for such long-term, high-risk metrology research and development. The Physics program interacts with numerous

industry advisory groups, such as the Council for Optical Radiation Measurements (CORM) and the Council on Ionizing Radiation Measurements and Standards (CIRMS), to help plan the direction of the Physics program's measurement services and research.

The FY 2001 base program operating objectives include:

- Commission nanoscale physics facility for characterization of electric, magnetic, and structural properties of quantum-electronic devices for use in next generation electronic circuits.
- Develop advanced color and appearance measurement facilities to support industries relying on product appearance for competitive purposes.
- Develop and apply high-resolution x-ray scattering methods to characterize advanced optical materials, magnetic thin films, and semiconductor structures for the microelectronic industry.
- Develop dosimetry and radioactivity standards for new radioactive sources for use in prostate cancer therapy, and for use in preventing restenosis following balloon angioplasty.
- Develop a system for making optical-frequency measurements relative to the cesium frequency standard in support of industrial requirements for length metrology and optical-frequency measurements.
- Establish Synchrotron Ultraviolet Radiation Facility (SURF III) as an absolute radiometric source to be used for calibration of remote sensing devices and transfer standards by developing beamlines for characterization.
- Conduct research to explore manipulation of atomic and ionic states for new measurement science, including laser cooling and trapping of atoms and ions for new frequency standards, laser manipulation of atoms for production of nanostructures for semiconductor metrology, and production of custom quantum atomic and ionic states for research into quantum computing.

Performance Measures
(All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the General Statement.

The NRC Assessment Panel for the Physics program met on March 11-12, 1999 and has provided the following findings: “The work of the [PL] is a mix of both basic and applied research. The basic research, in particular, calls for assessment against standards of quality rather than numerical objectives. Overall, the panel found the work of the laboratory to be of high technical merit. The staff of the laboratory represent one of the world’s finest assemblages of talent in many areas of physics. In many cases, research is at or defines the state of the art in its field. Research programs and projects are generally appropriate to the mission of the laboratory and of NIST.” The full report of the Panel’s findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: <http://www.nap.edu/books/NI000763/html>.

The NRC Assessment Panel for the Physics Laboratory will meet again on March 13-14, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratories’ facilities, equipment, and human resources.

The Physics program has strong impacts on U.S. industry and society. An economic impact study of the Physics program’s Radiopharmaceutical Standard Reference Materials program, which provides the standards for assuring the safety and effectiveness of 6,000,000 diagnostic and 50,000 therapeutic nuclear medicine procedures performed annually in the U.S., found an internal rate of return of 138 percent and a benefit-to-cost ratio of 97 to 1.

The Physics program provides a wide range of additional standards and measurements services that broadly affect consumer health and safety as well as industrial innovation and economic efficiency. For example:

Health:

- Providing the national standards for the 11,000 U.S. mammography facilities, assuring the safety and effectiveness of 26 million diagnostic mammograms annually;

Safety:

- Providing the national photometric standards for anticollision lighting on commercial aircraft to improve safety in cooperation with the Federal Aviation Association.

Innovation:

- Providing high accuracy optical measurements critical to developing future generations of photolithography to make smaller, faster microelectronic devices.

Quality and efficiency:

- Providing the national standards for exposure quality, which are central to high quality and efficiency levels in the photographic and x-ray film industries. In 1997, these industries added \$6.7 billion in value to the U.S. economy and generated revenues of \$11.4 billion.
- The NIST Time and Frequency Division currently provides time via the Internet to more than 12 million visitors daily. The demand for Internet time from NIST is driven by several constituencies, including U.S. regulatory agencies such as the Securities and Exchange Commission (SEC) who require traceability to NIST time for commercial stock transactions and everyday citizens who are able to see the Official Time for the United States on the world wide web at: www.time.gov

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

		2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Physics.....	Pos./Approp	164	\$29,454	180	\$39,454	16	\$10,000
	FTE/Obl.	169	29,556	181	37,756	12	8,200

Nanotechnology (+16 Permanent Positions, +12 FTE, BA +\$10,000,000, Direct Obligations +\$8,200,000, Transfer to WCF +\$1,800,000) - To provide measurements, standards, and test methods for private sector development of advanced nanotechnologies, including applications in most major industrial sectors such as health care, semiconductors, communications, defense, biotechnology, and magnetic data storage. These measurements and standards are needed to ensure U.S. economic and technical leadership in these key fields which will be increasingly driven by advances in nanotechnology. NIST will develop the critical enabling infrastructural measurement and standards in the areas of nanodevices, nanomagnetics, nanomanipulation, and nanocharacterization. These efforts support the White House nanotechnology priority and the recommendations of the President's Committee of Advisors on Science and Technology.

Problem Magnitude and NIST Role:

Nanotechnology will be a dominant technology in the next century. Only recently possible, nanotechnology represents the ultimate in manufacturing through the knowledgeable use of the building blocks of all matter – atoms and molecules. This new capability has the potential to fundamentally change our everyday lives. U.S. industry, including manufacturing, materials, health care and electronics, will use nanotechnology in the future or find that they cannot effectively compete in global markets. This field offers tremendous opportunities for economic growth and improvement in U.S. competitiveness. The small size and low expense of nanodevices will expand the reach of technology to all areas of the U.S. For example, nanotechnology solutions to health care diagnosis systems -- the “lab-on-a-chip” -- will allow the most remote areas of the U.S. to have the most advanced health care technologies. Supporting

industrial nanotechnology applications requires NIST to develop a new genre of standard materials, data, and measurement systems specifically designed for the nanoworld. The technical risks in this world are very high as an individual molecule that is "out-of-place" may cause a device to fail. But the new discoveries and materials being generated in nanotechnology offer countless opportunities for commercial innovation, from bioimplants that automatically regulate pharmaceutical dosage to atomic manipulation in a manufacturing plant that creates new ultrahigh density data storage media. All these new technologies require atomically accurate measurement capabilities, standard materials and data to allow industry to design, manufacture, and assure the quality of their products.

European and Japanese governments are investing heavily in nanotechnology research. NIST must significantly increase its work with U.S. industry to develop the measurement and standards infrastructure that is crucial for this innovation and to ensure that technical requirements of international standards do not put U.S. manufacturers at a disadvantage.

NIST's fundamental mission is to support U.S. industry with the measurements, standard materials and data needed for global competitiveness and to ensure continued economic growth. NIST is the only organization that has the mission and the necessary combination of staff expertise, experience, industry contacts, industry respect, and worldwide recognition as the leading measurement and standards institution. NIST has unique experience in working with the breadth of industries impacted by nanotechnology, from electronics to biotechnology. Research into such measurement areas as quantum electron counters for high accuracy electrical calibrations, giant magnetoresistance for magnetic data recording, DNA diagnostics for health care, and atomic scale imaging and spectroscopies for semiconductor technology has made NIST a world leader in nanotechnology. NIST staff expertise in materials, electronics, physics, chemistry, and manufacturing technology makes NIST uniquely qualified to address the high risk scientific and technological challenges associated with developing the measurement techniques and technical standards needed in this new field.

NIST is a member of the NSTC Interagency Working Group on Nanotechnology and is coordinating our efforts with other Federal scientific agencies to ensure their programs will have the enabling measurements and standards necessary for success.

Proposed NIST Technical Program:

At the proposed funding level, NIST will develop the critical enabling infrastructural measurement and standards in the areas of nanodevices, nanomagnetism, nanomanipulation, and nanocharacterization.

Nanotechnology depends on the manipulation of quantities of matter on the order of single atoms and molecules. This manipulation can be approached from two directions, commonly referred to as the "top-down approach" and "bottom-up approach" to manufacturing things with nanodimensions. Top-down technologies, such as semiconductors and magnetic data storage, have evolved

over the years from large centimeter scales down to smaller and smaller dimensions, until they will soon approach atomic or nanoscale dimensions. Top-down manufacturing is the source of most existing and near-future industrial applications of nanotechnology. Semiconductor manufacturing tools such as lithography permit structures to be mass manufactured with critical dimensions at the 200 nanometer (nm) level, with finer structures at the 70 nm level and below proposed by the year 2008. The same technology used to create computer chips can be applied and modified to develop a wide array of new nanotechnologies, including bioelectronic devices for health care and new measurement systems for absolute calibration. The nanodevices and nanomagnetism portions of this initiative will provide industry's measurement and standards needs for current and near term applications of nanotechnology. In the nanodevice portion, NIST applies these top-down approaches to the development of new measurement and calibration methods and standards.

Bottom-up manufacturing -- building useful objects from single atom or molecular building blocks -- is based on nanomanipulation and is the source of new nanomaterials such as fullerenes, carbon nanotubes, and novel demonstrations such as recording information by selective placement of single atoms. Such work is the likely basis of scientific advances that will lead to future commercial applications. The instrumentation to accomplish such manipulations of matter, to characterize the results, and to interact with the products is the critical core of nanotechnology. The nanocharacterization focus of the initiative is for the development of measurements and standards that are necessary for all approaches to nanotechnology and are in high demand by a broad base of U.S. industries.

Nanotechnology is a broad field with diverse industry needs. In order to leverage our efforts and efficiently and effectively meet the measurement and standards needs of U.S. industry while maintaining our institutional flexibility and responsiveness to rapidly changing customer needs, NIST will develop stronger strategic alliances/collaborations with universities, businesses and other government agencies that possess leading expertise in nanotechnology to conduct much of the specific work required to meet the goals of this initiative and avoid developing costly, complex in-house capabilities that will be used only once. The university alliances will also help educate the U.S. workforce in nanotechnology related problems, and permit NIST scientists and engineers to concentrate on the critically needed metrology and research, while contracting out development of specific equipment and techniques. Building these partnerships will return greater value to the taxpayers for their investment in nanotechnology.

Nanodevices: NIST will develop measurements and standards for the nanotechnology industry using the evolving top down approach, including the semiconductor, communications, and health care industries. NIST will also use the top-down approach to develop new measurement techniques and standards. This focus will allow NIST to meet the short- to medium-term needs of U.S. industry. NIST proposes the following areas of nanodevice research:

- NIST will develop a suite of quantum standards that attain near absolute accuracy for exact calibration of physical parameters (e.g.,

electrical, mass, force, and chemical analysis.)

- NIST will develop measurements and standards that support the use of new semiconductor processing and manufacturing approaches, including: standard data to support deep UV and X-ray lithographic methods; measurement techniques to determine the effectiveness of plasma processing and rapid thermal processing; X-ray optics and single-ion etching/lithography; and a variety of dimensional, electrical, chemical, nanoparticle contamination, and other standard materials that will be made to meet the rising demand from the semiconductor manufacturing industry.
- Nanoscale versions of table-top analysis instruments, frequently referred to as “lab-on-a-chip” technology, promise to revolutionize many chemical and physical measurements with wide ranging applications in health care, environmental, and industrial process monitoring. These devices will move many laboratory measurements into the field, e.g., to the doctor's office or the plant floor. NIST will develop measurements and standards supporting this growing technology area, including dimensional, chemical, and electrical standards that are needed to assure the quality of results from these devices. The masses and volumes measured by these devices are much smaller than previously attained and NIST will need to develop methods to make standards that are homogeneous at the nanoscale level, a new requirement for many of our standard materials.

Nanomanipulation: The bottom-up synthesis approach uses nanomanipulation to develop nanomaterials and devices, such as self-assembled monolayers and multilayers and scanning probe manipulators, from atomic and molecular scale manipulation. This initiative in nanomanipulation will include the following areas:

- To achieve high volume production in nanoscale manufacturing, it will be necessary to mimic nature’s strategy of self-assembly and self-replication. Progress in the area of self-assembly of thin films is being made; however, better measurements of the forces governing self-assembly are needed to enable assembly of the complex structures desired for catalysis, sensing, molecular separations, biomaterials, and molecular electronic devices. NIST will develop standards for autonomous atom assembly to permit detailed measurement of their physical, electronic and magnetic properties.
- Many manufacturing processes can be controlled and manipulated in more accurate and novel ways if we understand the mechanics of nanoscale systems, including nanofluidics and nanoparticulates. NIST will develop single particle tracking, manipulation, and measurement methods for investigation of molecular transport in biological, bio-mimetic, and bio-engineered metallic oxide films and membranes and other manufacturing processes.
- A great challenge for computational research is the accurate and reliable estimation of the properties, reactivity, and bulk behavior of molecules in the condensed phase, including solutions, surfaces, solids, and interfaces. NIST will integrate first-principles, predictive quantum methods with atomistic statistical methods for sampling configurations and properties at finite temperature and pressure. To date, this has been accomplished for only the simplest systems. This capability will supercede current empirical methods and simplistic models. Many roadmaps and workshops have highlighted the need for work in this important area from the

point of view of process and product design in the 21st century.

Nanocharacterization: Tools for visualization and characterization are vital to understanding nanotechnology. Measurement and characterization at the nanoscale are necessary to understand the nature of nanomanufacturing processes, to assess the purity of nanoscale products and components, and to understand mechanisms of interaction of the product with its environment, including failure during operation. Industry requires a new set of characterization tools and standards since existing characterization approaches and standards are insufficient, lacking the necessary spatial resolution or specificity needed for nanotechnology. Industry cannot successfully make nanodevices or components until they can be accurately measured and characterized. NIST will develop measurement methods and standards that allow atomic scale resolution in three dimensions with accurate physical and chemical functional specificity. NIST proposes:

- To develop smart measurement probes sensitive to electronic, magnetic, chemical or biological properties, e.g., a nano-tip including a single electron transistor for ultra-sensitive charge measurements, a superconductor tip for electron spin detection, or chemically/biologically functionalized tips for nanoscale analysis to support semiconductor, chemical and materials processing, pollution monitoring, medical diagnosis, and food quality control. The weak link in such measurements has always been the specificity of the detection material. The recent development of molecularly-tailored nanostructures composed of metals, semiconductors, polymers, or DNA opens exciting new opportunities for sensing. NIST will develop both new sensors and the electrical and optical measurement methods to enable the use of these chemically and physically selective nanomaterials in measurement devices. These new probes will allow NIST to support the increasing use by industry of combinatorial approaches to materials characterization and synthesis.
- To develop measurement instrumentation and the theoretical basis for interpreting images and analyses including the quantitative 3-D measurement methods to allow accurate interpretation of chemical, physical, and dimensional data from these new technologies, neutron and x-ray reflectometry, small angle scattering, and spectroscopic analysis, and standard materials and data. The techniques of microscopy and nanoanalysis based upon beams of electrons, ions, photons, neutrons and scanned probes are key assets in the nanotechnology fields.

Nanomagnetics: The magnetic data storage industry is an example of the widespread commercialization of nanotechnology. Magnetic storage bits on new computer hard disks currently measure 80 nanometers by 500 nanometers, and read/write head flying distances are only 20 nanometers. The trend in information storage continues toward higher information density and higher access speed, both of which double every two to three years. Many problems and challenges face the magnetic information storage industry at this especially critical time. NIST proposes to work in the following areas:

- Magnetic Bit Stability and Kinetics in Thin Films. NIST will develop ultra-high-speed measurements of magnetization dynamics for characterization of speed capabilities of thin film materials to support gigabyte storage. At the other extreme is the need for multi-year stability of a bit once it is written, despite thermal fluctuations, which can degrade very small-area bits. Measurements and models will be developed to meet these industrial needs.
- Imaging Methods for Nanomagnetism. With recording bits having sizes as small as 250 by 25 nanometers, being able to image possibly misaligned magnetic structures as they are recorded is a critical capability for design engineers. NIST will realize this measurement capability with the development and application of a microscope which uses electron spin and other methods to image magnetic domains.
- Physical Standards for Magnetic Measurements. New standards are needed by industry for measurements on read/write heads and magnetic disks. This project will produce standards for films having a magnetic moment 100,000 times smaller than references now available from NIST.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Nanotechnology Initiative	
Technical Area	Outputs
Nanodevices	<ul style="list-style-type: none">• Develop two new standard reference materials for semiconductor, lab-on-a-chip, and other nanotechnologies• Develop new quantitative measurement methods for analysis of physical and chemical properties of industrial nanoscale devices such as semiconductors• Publish one paper per year on the development of measurement methods, standard reference materials, and calibration systems.
Nanomanipulation	<ul style="list-style-type: none">• Develop standards for autonomous atom assembly.• Develop modelling and simulation programs for condensed phases, including solutions, surfaces, solids, and interfaces• Publish one paper per year on the development of manipulation and modeling data, algorithms, and related research.
Nanocharacterization	<ul style="list-style-type: none">• Develop three new standard reference materials for calibration and quality assurance of commercial analysis laboratories and instruments.• Develop several 3-D measurement methods for the analysis of physical and chemical at or near atomic spatial resolution.• Publish one paper per year on the development of measurement methods and standard reference materials.
Nanomagnetics	<ul style="list-style-type: none">• Develop stability and kinetics measurement systems and standard data for magnetic thin films.• Develop two new standard reference materials.• Publish one NIST paper per year and two university partnership papers per year on the measurements and standard reference materials for magnetic data storage.

Performance Measures: Outcomes

Only a few examples of nanotechnology commercialization are apparent today. These are the semiconductor and magnetic data storage industries. Both these industries are helping the U.S. to be competitive in world markets and can lead to general conclusions about the impact of nanotechnology as it enters more market sectors in the 21st century.

The standards and measurements developed at NIST will continue to help U.S. industry maintain and improve leadership of the \$200 billion computer and peripheral market, which will be increasingly dependent on nanotechnology. Most of the U.S. electronics manufacturing supplier infrastructure firms are small. For example, of the 192 member companies of SEMI/SEMATECH, 109 have annual sales of \$10 million or less and 161 have annual sales of \$100 million or less. As the large semiconductor firms move rapidly toward nanodimensions, these small businesses will constantly be under pressure to catch-up. NIST will provide these firms with the measurements and standards infrastructure that will allow them to maintain their high technology edge.

Giant MagnetoResistance (GMR) is a nanoscale effect that was discovered approximately 10 years ago and now dominates the \$35 billion U.S. magnetic data storage industry. Companies that did not invest in GMR technology early in its development have been left behind in the rapidly changing, highly competitive information technology storage market. With declining hard disk market share, NIST must provide the measurement infrastructure to help keep U.S. industry strong. Standards are not only important for manufacturing, but also for commerce. Most manufacturers assemble their drives from heads, disks, motors, suspensions, and electronics made by other companies. NIST must play its historical role of minimizing disputes between buyers and sellers through impartial standards to maintain international commerce.

This initiative is designed to broadly benefit most sectors of the U.S. economy through new innovations in nanotechnology, which is a critical enabler for information technology, manufacturing, health care, defense applications, automotive, communications, plastics, and many other economic sectors. This initiative is designed to improve U.S. leadership in the \$400 billion telecommunications industry and improve U.S. share in the \$35 billion magnetic data storage technology.

In the United States, over 14 percent of GDP is related to expenses associated with the treatment of chronic illness and acute care. Currently, there are over 100 million Americans with chronic illness, including heart disease, arthritis, diabetes, depression, asthma, and Alzheimer's disease. Chronic illness, which correlates to aging, accounts for at least 70 percent of hospital admissions and half of all emergency room visits. The U.S. population is aging rapidly. Today, every eight seconds a baby boomer turns fifty, totaling 11,000 fiftieth birthdays every day. Projections are that by the year 2020 17 percent of the American population will be over the age of 65, significantly increasing the incidence of chronic illness and associated health care costs. Nanotechnology will greatly impact the efficiency and availability of advanced health care diagnostics and treatments to U.S. citizens. Nanosensors, "lab-on-a-chip"

diagnostic systems, and nanoimplants will replace many currently expensive technologies with higher quality, lower cost nanotechnologies. NIST will develop the measurements and standards necessary to allow industry to design, manufacture, and assure the quality of these devices.

Because nanotechnology is in its initial stages of discovery and growth, many effects cannot be imagined let alone accurately predicted. The Interagency Working Group on Nanotechnology predicts that this technology will have a major effect on every industrial sector. This new technology area requires a large infrastructure to aid rapid U.S. commercialization of new discoveries. A major portion of that infrastructure is NIST-based measurements and standards that industry must use to see if and how well their products work.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Physics

Program Change: Nanotechnology

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Electrical engineer	ZP IV	3	71,861	215,583
Materials science engineer	ZP IV	2	71,861	143,722
Mechanical engineer	ZP IV	1	71,861	71,861
Physicist	ZP IV	4	71,861	287,444
Research chemist	ZP IV	3	71,861	215,583
Electrical engineer	ZP III	1	51,138	51,138
Physicist	ZP III	2	51,138	102,276
Subtotal		<u>16</u>		<u>1,087,607</u>
Less lapse	25 %	(4)		(271,901)
Total full-time permanent (FTE)		<u>12</u>		<u>815,706</u>
2001 Pay Adjustment (3.7%)				30,183
Total				<u>845,889</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		12		
Authorized Positions:				
Full-time permanent		16		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Physics

Program Change: Nanotechnology

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$845
11.9 Total personnel compensation	845
12.1 Civilian personnel benefits	208
21 Travel and transportation of persons	217
22 Transportation of things	81
23.3 Communications, utilities and miscellaneous charges	269
24 Printing and reproduction	93
25.1 Advisory and assistance services	0
25.2 Other services	263
25.3 Purchases of goods and services from Government accounts	298
25.5 Research and development contracts	5,060
25.7 Operation and maintenance of equipment	170
26 Supplies and materials	447
31 Equipment	249
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 8,200
Transfer to NIST Working Capital Fund	1,800
Total increase requested	<hr/> 10,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Physics
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY 2001 <u>Estimate</u>
Department of Defense			
Air Force	\$2,761	\$2,687	\$2,690
Army	271	383	380
Navy	1,440	1,241	1,250
Other	<u>800</u>	<u>850</u>	<u>900</u>
Subtotal, Department of Defense	5,272	5,161	5,220
Department of Commerce	32	40	40
Department of Energy	951	970	970
Department of Health & Human Services	11	15	15
Department of Transportation	18	18	18
Environmental Protection Agency	35	37	38
National Aeronautics & Space Administration	2,476	2,572	2,575
National Science Foundation	89	70	70
Nuclear Regulatory Commission	98	100	100
Other	<u>78</u>	<u>45</u>	<u>50</u>
Total, Other Agency	9,060	9,028	9,096
Calibrations & Testing	1,010	1,045	1,060
Standard Reference Materials	213	215	215
Technical & Advisory Services	3,118	3,180	3,180
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>1,800</u>
Total, Other Reimbursables	4,341	4,440	6,255
Grand Total, Reimbursable Program	13,401	13,468	15,351

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Materials science and engineering

			1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
			Actual		Currently Available		Base		Estimate			
<u>Line Item</u>			<u>Per-</u>	<u>Amount</u>	<u>Per-</u>		<u>Per-</u>		<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>
			<u>sonnel</u>		<u>sonnel</u>	<u>Amount</u>	<u>sonnel</u>	<u>Amount</u>	<u>sonnel</u>		<u>sonnel</u>	<u>Amount</u>
Materials science and engineering	Pos./Approp		358	\$51,114	348	\$51,013	352	\$54,486	365	\$58,986	13	\$4,500
	FTE/Obl.		361	50,037	358	53,129	361	54,658	371	57,658	10	3,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Materials science and engineering

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Materials science and engineering										
Direct obligations		0		0		0		\$1,500		\$1,500
Reimbursable FTE/Obl	<u>42</u>	<u>\$6,755</u>	<u>43</u>	<u>\$6,100</u>	<u>43</u>	<u>\$5,475</u>	<u>42</u>	<u>5,475</u>	<u>(1)</u>	<u>0</u>
Total	42	6,755	43	6,100	43	5,475	42	6,975	(1)	1,500

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
MATERIALS SCIENCE AND ENGINEERING

Goal Statement

The goals of this subactivity are to (1) enhance the competitiveness of American industry by providing measurement support for industry's development and commercialization of appropriate broad-based technologies and diffusing these advances to users in all segments of the American economy, and (2) provide measurements, calibrations, and quality assurance techniques which underpin U.S. commerce, technological progress, improved product reliability, and manufacturing processes. The Materials Science and Engineering subactivity addresses the scientific, measurement infrastructure, data, and standards issues that are crucial to industry's success in exploiting the potential technological advantages of advanced materials. This subactivity also contributes to the development of in-process sensors and process technologies which control the transformation of these materials from laboratory research to commercial products and to manufacturing processes needed to consistently yield high quality products at reasonable costs. The research programs are built around a number of continuing activities designed to identify and address industry's most pressing measurement needs and transfer NIST-developed technology to industry quickly and effectively, utilizing joint research, consortia, the Guest Researcher program, access to unique NIST facilities, memberships on standards committees, publications, conferences, seminars, workshops, and Cooperative Research and Development Agreements (CRADAs). This program also supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

Technological progress in such diverse fields as electronics, transportation, health care, energy, and aerospace, rely on the development of advanced materials with property and performance characteristics far superior to materials used today. The technological and economic goals of many countries are tied to advances in materials, resulting in intense international competition. Recent advances in the development of advanced ceramics, metals, polymers, and composites, as well as advanced processing technology for all of these materials, have revealed a few of the future technological possibilities. Examples of these technologies include the ability to microengineer materials to create structures and combinations of elements unknown in nature, with properties and phenomena that

until recently were unachievable. The challenge is to move these new materials from the laboratory into commercial products and to develop the necessary manufacturing processes for the transition.

Appropriate national and international measurement standards facilitate commerce in advanced materials and devices. These standards reduce time for material, process and product development. Standards provide a basis for consistent manufacture of high quality products at reasonable cost. The Materials Science and Engineering subactivity conducts research leading to (1) the development of standards, test methods, reference data, and reference materials; and (2) a scientific understanding of the underlying chemical and physical bases of materials processing, properties, and performance. This subactivity also operates the NIST Center for Neutron Research to provide the industrial and academic communities with unique measurement tools.

The FY 2001 base program operating objectives include the following:

- Work with other national and international organizations to standardize critical mechanical test procedures needed by the U.S. materials industry. Participation and coordination of standards activities promote the acceptance of U.S. goods and services in the global marketplace, thereby improving the balance of trade.
- Support the electronics industry in their pursuit of higher speed devices by developing experimental and computational techniques to measure the properties of polymer and ceramic thin film materials and metallic electrical interconnects. Techniques have been developed for more accurate measurement of many properties (*e.g.*, thermal expansion, moisture content, and characteristics of microstructure) important to microelectronics performance, and advanced measurement methods are now being applied to understand why some of these properties change with time. These measurements and data assist the U.S. microelectronics industry to design a new generation of electronic products more quickly and economically than their competitors.
- Develop measurement methods and Standard Reference Materials for evaluating the quality and performance of materials to support the rapid development of advanced products for the next generation of wireless communications. The availability of these measurement methods enables more cost-effective manufacture of related products with recognized high quality.
- Assist the U.S. automotive industry in cost-effective use of lightweight materials for the next generation of energy efficient vehicles through measurement, modeling, and standards activities. Data and models have been developed describing the fabrication of aluminum-matrix composite parts from powders, and measurements of deformation and surface roughening of sheet metal during stamping have been started. This research is designed to enable the U.S. automotive industry to produce automobiles that are lighter and more fuel efficient without sacrificing performance.

- Enhance unique U.S. capability at NIST to provide essential support for users from industry, academia, and other government agencies to use cold neutrons to measure key properties of new chemicals, materials, and biological assemblies. These measurements shorten the time from materials design to materials implementation in industries such as chemicals, transportation, and biotechnology.
- Assist the U.S. polymer industry to develop new, low cost, high volume polymers by developing methods that measure the performance of reinforcing fillers. These methods will allow the development and use of new low cost, high volume polymers necessary in applications such as automotive manufacturing.

Performance Measures
(All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the Executive Summary.

The NRC Assessment Panel for MSEL met on March 4-5, 1999, and the NRC Assessment Subpanel for NCNR met on January 26-27, 1999. The NRC Assessment Panel for MSEL has provided the following findings: “The panel found the quality of all programs to be very high as well as supportive of the laboratory’s mission to stimulate more effective production and use of materials by working with materials suppliers and users to ensure the development and implementation of the measurements and standards infrastructure for materials. As confirmed by recent literature citation index analyses, surveys, and workshops, the advances by the laboratory are held in the highest regard by materials industry and research personnel both in the United States and abroad. This leadership in the characterization and measurement of materials is very important to maintaining U.S. materials industries’ strong position in the global marketplace.” The full report of the Panel’s findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at <http://www.nap.edu/books/NI000763/html>.

The NRC Assessment Panel for the Materials Science and Engineering Laboratory will meet again on March 16-17, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratory's facilities, equipment, and human resources.

Relative to the NCNR, the NCNR Subpanel concluded: "The NIST Center for Neutron Research has exhibited excellent safety and performance while serving an ever broader range of users of its unique facilities."

The NIST Center for Neutron Research (NCNR) is a world-class national user facility with unique materials measurement capabilities. Over 1,400 non-NIST scientists and engineers from more than 50 U.S. companies, 90 universities, and 30 government agencies participate in research projects at the NCNR every year. The NCNR is operated with a high degree of efficiency, and lost time due to unscheduled shutdowns is routinely held to less than two percent for the reactor and five percent including all instrument failures.

In FY 1998, MSEL completed a study of the economic impact of the ceramic phase diagram program. These evaluated diagrams are used throughout the materials community for materials design, processing and application. Over five years, this activity was conservatively estimated to result in a ten to one benefit to cost ratio and a 33 percent rate of return. Building on lessons learned in formulating the study of ceramic phase diagrams and evaluating the results, MSEL will select other technical activities to be similarly assessed. Such economic impact studies will provide more detailed and quantitative assessment of the outcome for selected components of MSEL's technical agenda and provide guidance in choosing MSEL's future technical activities.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

					Increase/(Decrease)		
					Over 2001 Base		
					Personnel	Amount	
					Personnel	Amount	
Materials science and engineering	Pos./Approp	352	\$54,486	365	\$58,986	13	\$4,500
	FTE/Obl.	361	54,658	371	57,658	10	3,000

Combinatorial methods (+13 Permanent positions, +10 FTE, BA +\$4,500,000, Direct Obligations +\$3,000,000, Transfer to WCF +\$1,500,000) - To provide an infrastructure foundation of measurements and standards to support new combinatorial methods of scientific discovery for use by the U.S. research and development community. Combinatorial methods (or combi-methods) refers to new techniques that dramatically speed research by simultaneously conducting a very large number of experiments where important parameters (such things as temperature, concentration, chemical composition, etc.) can be systematically varied and the effects quickly determined. Combi-methods are so much faster than traditional sequential methods (where one experiment is finished and analyzed before the next is begun) that whole new areas of investigation are opened. Combi-methods are used, for example, to explore the properties of new pharmaceuticals or new materials by conducting a very large number (hundreds or thousands) of simultaneous experiments rather than the much slower process of sequentially conducting one experiment after another. Combi-methods combine advances in information technology with state-of-the-art chemistry, physics, biology, materials science, and other disciplines to much more rapidly conduct experiments. Combi-methods are being rapidly adopted by industry (particularly the chemical and pharmaceutical industries) to speed discovery and development of new products and processes. Combinatorial methods have revolutionized drug discovery in the pharmaceutical industry and are poised to do the same in materials science, biotechnology, chemistry, physics and other scientific disciplines with experimental bases. These efforts are needed to maintain U.S. leadership in chemicals and materials R&D by providing dramatic increases in efficiency of process optimization and materials discovery. The initiative will generate valuable infrastructure technologies in the areas of chemical/materials discovery and development and will improve the productivity and quality of high technology research and development, impacting a broad range of U.S. industry and society in general.

Problem Magnitude and NIST Role:

The U.S. chemical process industry has annual revenues over \$400 billion and supports the downstream innovations of other critical U.S. industries through product applications such as high-performance engineering plastics used in automotive components, high-purity solvents and feedstock used for semiconductor wafer processing for the information revolution, and innovative specialty chemicals used as reaction intermediates for ethical drugs, pesticides, and biomedical applications that will support future developments in tissue engineering. U.S. industry depends on new developments in materials and processing to satisfy the competing needs of lower cost and higher performance. Innovations in the chemical process industry support over \$1.2 trillion in product sales and service for the downstream value chains, including advanced materials for applications in communications, electronics, photonics, structural composites, and advanced packaging. Yet R&D funding within the chemical industry has been relatively flat over the last decade at about \$12-14 billion.

To understand the benefit of the quality of combinatorial methods, one might consider typical R&D efforts today. A typical research effort to create a useful new material requires an integrated team of about 6-8 scientists working over a period of three years at an estimated cost approaching \$6 million. Industry's goal with combinatorial techniques is to drive this cycle down to less than a year. Although promising to dramatically reduce the costs of materials discovery, the biggest impact of this capability will prove to be in the reduction in cycle time for the development of new materials in a global market that is rapidly becoming a winner take all arena. Businesses will grow or be lost based on their ability to lead in the increasingly competitive materials development race.

In the commodity chemicals area, combinatorial methods will have a major impact in providing dramatic increases in information to be used in optimizing process conditions as new catalysts move from the discovery phase through pilot plant and pre-commercial scale evaluation. Pilot plant campaigns often have costs approaching \$1 million and very short windows of availability every six months. New processes have to be ready to go to pilot when the opportunity arises. When using traditional R&D techniques, the amount of information available to select process conditions for a specific pilot run is limited. This restricts the range of parameters that are considered, and process parameters are rapidly frozen based on what works and not what is necessarily optimum. Combinatorial approaches offer the opportunity to rapidly collect information on a much broader range of process parameters, such that pilot runs are more productive, resulting in the need for fewer pilot plant campaigns, leading to less expensive but more efficient products and processes that reach the market faster. Support of the technology development of this initiative will speed the realization of these visions.

The use of combinatorial methods in materials discovery provides U.S. industry with the needed “game changing” opportunity for a dramatic increase in efficiency and thus an opportunity for a wide range of technological breakthroughs. This approach, known in

pharmaceuticals and biotech as “combinatorial chemistry” or “high-throughput experimentation,” has created a new paradigm for drug screening and design and is likely to have a similar dramatic effect on these areas of experimental research. The use of this approach in other areas of research is new; however, since being introduced into the materials world in 1997 with work on phosphors, the use of combinatorial methods is quickly being established in the research laboratories of a number of large U.S. corporations. Faster, better, smaller, and cheaper are the essential characteristics for materials development of the future. Yet without adequate measurement tools and standards for combinatorial approaches, new materials and applications will develop more slowly and inefficiently.

NIST can provide the critically needed measurement and standards infrastructure to support the new techniques needed by industry to most effectively use combinatorial techniques in materials and process development, such as rapid synthesis of large, diverse collections of complex materials, rapid measurement of properties of microscopic sized specimens, and effective use of the massive amounts of data generated in this process. NIST is the only organization that is uniquely capable of addressing these critical needs. NIST has the mission and the necessary combination of staff expertise, experience, industry contacts, industry respect, and worldwide recognition as the leading measurement and standards institution.

Through this technical program, NIST will address some of the major needs of industry, such as rapid experimental measurements from very small regions, efficient visualization of large quantities of data, moving from data to predictive models of materials properties, and feedback to improve the design of experiments. The availability of improved tools in these areas will improve the productivity and quality of the chemicals and materials R&D efforts in U.S. industry. As a second major benefit, these tools will provide enhancements to research conducted at NIST and other laboratories which are part of the U.S. R&D base.

NIST will work with industry to ascertain and develop the advanced metrology required for production and characterization of small discrete volumes of experimental sample arrays at high speed. NIST will also provide critically needed reference materials determined to be necessary as new techniques are developed.

Proposed NIST Technical Program:

NIST will develop the measurement and test methods, standards, and data management and mining methods needed by the U.S. chemicals and materials industries to exploit the new paradigm of high-throughput experimentation. This is a paradigm that has led to dramatic increases in R&D productivity and decreases in time-to-market in the pharmaceutical industry, but for which there are substantial technical barriers before there is broad application in the optimization of chemical processes and discovery of new materials. An integrated strategy is proposed to leverage specific core competencies across several NIST laboratories to accelerate advances in the highly cross-disciplinary area of combinatorial methodology applied to chemicals and materials.

Combinatorial Methods Testbed - A testbed for use in developing combinatorial methods will be developed at NIST to facilitate the development of tools and samples for the study and characterization of complex systems by NIST scientists. It will also provide a neutral ground for the evaluation of new instruments and models emerging from small technology providers, and for identifying and solving interoperability issues as they arise. The availability of such a resource to industrial collaborators will help reduce the financial and knowledge barriers, especially for small companies that might want to learn more about the potential of this methodology for their business. A key aspect of this initiative will be collaborations and other close ties with industry partners to ensure that the needs of industry are being addressed. This testbed will furthermore be suitable for use by research staff in academia. While university participation in this new field has been minimal to date, collaborations will be initiated with universities to bring this resource to bear on combi-methods issues. A workshop to demonstrate the testbed to industry and academia will be held during the first year of the initiative.

Materials Synthesis - One limit to the effectiveness of combinatorial methods is the quality of the “libraries,” or arrays, of materials generated. As part of this initiative, NIST will develop combinatorial synthesis techniques, which span the gas, liquid, and solid states, including novel approaches for materials synthesis such as ink-jet printing. These techniques will be analyzed to determine those which effectively reproduce structures attainable in mass production. These synthesis methods will be developed in the areas of polymers, metals, ceramics, and other areas of crucial importance to high technology fields as diverse as biotechnology and tissue engineering, ultrahigh strength structural materials, thin films and coatings, electronics, and flame retardants.

Micro-analytical Methods - Crucial infrastructural needs of the combinatorial methods field includes measurement tools and automated measurement techniques for the rapid characterization of microscopic samples and test methodologies that will accurately predict final product performance from analysis of microscopic samples. The NIST laboratories will develop innovations in materials characterization methodologies in several areas, focussing on developing accelerated test methods and correlating the results from these new methodologies to those from standard primary measurement techniques. In addition to these essential developments, new tools for micro- and atomic-scale materials characterization will be developed. This work will require a fundamental understanding of the underlying physics that determine materials properties. Resources to accomplish this are unique to NIST.

Robotics - There are two major infrastructural science challenges in the robotics area. The first deals with hardware and methodologies to obtain accurate three-dimensional information at the atomic scale for samples of novel materials (samples that might be extremely compliant or transparent, for example, and for which one does not *a priori* know pertinent materials properties). The second deals with the control languages used for the robotics instrumentation for the synthesis of the materials libraries and their analysis. Today there are emerging a few automated systems for synthesis or analysis, but they all use different programming. This makes it difficult for a chemist to work productively. NIST staff will work with scientists and engineers in industry and academia to

develop tools and robotics for accurate atomic-scale three-dimensional metrology and to develop guidelines for an open programming language or protocol.

Information Management - NIST will develop, and will publish via the World Wide Web, a universal metrics system, including descriptors and database designs, with the goal of capturing the complex types of information (including images) that will be generated and archived using combinatorial methods. An additional feature will be capability for data mining for discovery. Ultimately, such a system should be able to guide researchers in selecting which materials properties need to be captured, how to structure databases to store this information, and how to mine this information for the discovery of new materials.

Models to Guide Experimental Methods - To effectively apply combinatorial methods, aids are needed for the design of experiments. NIST will develop materials modeling and performance simulation programs that will guide future high productivity materials development programs through use of data provided in preliminary experiments. Coupled with this resource would be computational models to simulate or predict materials performance based on sample morphology and composition for very complex compositions. Publication of these urgently needed methods and software distribution requirements will be largely via the World Wide Web.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Combinatorial Methods Initiative	
Technical Area	Outputs
Combinatorial Methods Testbed	<ul style="list-style-type: none">• Develop testbed to develop and test new combinatorial research methods.• Develop at least two industry and two university collaborations using the testbed.• Beginning in the second year, publish at least one technical paper per year describing research results using the testbed.
Materials Synthesis	<ul style="list-style-type: none">• Develop new combinatorial techniques for gas, liquid, and solid state synthesis.• Beginning in the second year, publish at least one technical paper per year describing new synthetic techniques.
Micro-analytical Methods	<ul style="list-style-type: none">• Develop new high-throughput micro-analytical techniques for liquid, solid, and thin-film samples.• Beginning in the second year, publish at least one technical paper per year describing new micro-analytical techniques.
Information Management	<ul style="list-style-type: none">• Develop new methods for managing the vast amount of information needed to implement and interpret high-throughput analytical and synthetic processes.• Beginning in the second year, publish at least one technical paper per year describing new data handling techniques for combinatorial methods.
Models to Guide Experimental Methods	<ul style="list-style-type: none">• Develop models and simulations to guide future high-throughput materials development programs.• Beginning in the second year, publish at least one technical paper per year describing new models and simulations.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- Critically needed infrastructural tools, measurements, and standards for combinatorial methods in a range of technical disciplines. These tools will provide U.S. industry with capabilities needed to lead the world in the next generation of materials and process development; and
- Enhanced U.S. R&D efficiency, improved product quality, and increased productivity for a wide range of industries involved in new materials development and applications.

Examples of the potential impact of this technology are wide ranging, for example:

- Small U.S. equipment providers will develop technology components that will increase the productivity of companies engaged in chemical process and materials development.
- The interoperability of emerging combinatorial tools (including robotics and materials-informatics databases) will develop a high level of competitiveness and provide diverse instrumentation choices to industry, factors which result in more effective use of scarce industry R&D funds.
- An explosion of information and modeling for the materials properties and performance of complex systems, providing the knowledge and understanding needed for guiding future materials discovery and process optimization activities.
- Small- and medium-sized chemicals and materials companies will have the opportunity to evaluate competing tools and to learn how to conduct high productivity R&D without the massive expenditures (and high risk of failure) that would otherwise be required.
- Relevant training of our next-generation scientists and engineers in leveraging of high productivity tools and methodologies will help bring the combinatorial methods revolution to U.S. universities.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Materials science and engineering

Program Change: Combinatorial methods

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Chemist	ZP V	1	84,530	84,530
Physicist	ZP V	1	84,530	84,530
Chemical engineer	ZP IV	2	71,861	143,722
Materials science engineer	ZP IV	2	71,861	143,722
Physicist	ZP IV	2	71,861	143,722
Research chemist	ZP IV	1	71,861	71,861
Chemical engineer	ZP III	1	51,138	51,138
Electrical engineer	ZP III	1	51,138	51,138
Mechanical engineer	ZP III	1	51,138	51,138
Administrative/technical support	ZA II	1	35,265	35,265
Subtotal		<u>13</u>		<u>860,766</u>
Less lapse	25 %	(3)		(215,192)
Total full-time permanent (FTE)		<u>10</u>		<u>645,574</u>
2001 Pay Adjustment (3.7%)				23,886
Total				<u>669,460</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		10		
Authorized Positions:				
Full-time permanent		13		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Materials science and engineering

Program Change: Combinatorial methods

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$669
11.9 Total personnel compensation	669
12.1 Civilian personnel benefits	163
21 Travel and transportation of persons	84
22 Transportation of things	13
23.3 Communications, utilities and miscellaneous charges	140
24 Printing and reproduction	17
25.1 Advisory and assistance services	0
25.2 Other services	80
25.3 Purchases of goods and services from Government accounts	81
25.5 Research and development contracts	1,523
25.7 Operation and maintenance of equipment	97
26 Supplies and materials	99
31 Equipment	34
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<u>3,000</u>
Transfer to NIST Working Capital Fund	1,500
Total increase requested	<u>4,500</u>

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Materials Science and Engineering
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Department of Defense			
Air Force	\$132	\$500	\$400
Army	176	25	0
Navy	28	0	0
Other	<u>435</u>	<u>225</u>	<u>200</u>
Subtotal, Department of Defense	771	750	600
Department of Energy	677	650	500
Department of Health & Human Services	861	900	800
Department of Justice	0	200	100
Department of Transportation	291	225	200
National Aeronautics & Space Administration	283	300	300
National Science Foundation	1,333	1,550	1,550
Nuclear Regulatory Commission	239	75	75
Other	<u>362</u>	<u>250</u>	<u>250</u>
Total, Other Agency	4,817	4,900	4,375
Standard Reference Materials	899	800	800
Technical & Advisory Services	1,039	400	300
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>1,500</u>
Total, Other Reimbursables	1,938	1,200	2,600
Grand Total, Reimbursable Program	6,755	6,100	6,975

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Building and fire research

<u>Line Item</u>		1999		2000		2001		2001		Increase/ (Decrease)	
		<u>Actual</u>		<u>Currently Available</u>		<u>Base</u>		<u>Estimate</u>		<u>Over 2001 Base</u>	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Building and fire research	Pos./Approp	106	\$14,829	100	\$14,732	100	\$15,248	100	\$13,888	0	(\$1,360)
	FTE/Obl.	108	14,941	104	14,887	104	15,292	104	13,932	0	(1,360)

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Building and fire research

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Building and fire research										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>70</u>	<u>\$9,088</u>	<u>71</u>	<u>\$11,422</u>	<u>71</u>	<u>\$12,035</u>	<u>71</u>	<u>\$12,035</u>	<u>0</u>	<u>0</u>
Total	70	9,088	71	11,422	71	12,035	71	12,035	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
BUILDING AND FIRE RESEARCH

Goal Statement

The goals of this subactivity are to enhance the competitiveness of U.S. industry and public safety through performance prediction, measurement technologies, and technical advances that improve the life cycle quality and economy of constructed facilities as well as the health and safety of U.S. citizens. The Building and Fire Research subactivity provides precompetitive and supporting/enabling technologies to the construction and fire safety industries, which typically under-invest because of inability to capture sufficient returns and for which NIST has specialized facilities and expertise. The program is built around several continuous activities which are designed to identify industry's most pressing needs and transfer NIST-developed technology to industry quickly and effectively through mechanisms including joint research, the Research Associate program, memberships on standards committees, publications, conferences, seminars, workshops, and Cooperative R&D Agreements (CRADAs). This program also supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

The Building and Fire Research Laboratory is the national laboratory dedicated to providing measurement technologies and performance prediction methods to enhance the life cycle quality and economy of constructed facilities - including residential, commercial, institutional, industrial, and infrastructural. Its customers include all those who have a stake in constructed facilities. They cover a broad range of industries, institutions, and segments of the economy, specifically: suppliers and manufacturers; architecture, engineering, contracting, and construction firms; home builders and developers, standards writers, and code officials; fire services and disaster response communities; owners, occupants, and operators; maintainers and repairers of facilities; finance and insurance industries; and government agencies at the local, state, and Federal levels.

Accurate, timely, and efficient measurement technologies and performance prediction methods are essential for the competitiveness of these industries in global markets, for maintaining their leadership in domestic markets, and in meeting public needs for safety.

Performance metrics for the life cycle quality and economy of constructed facilities are needed to help industry capture the value added by improved products and services. The Building and Fire Research Laboratory conducts nationally recognized programs in major aspects of construction and fire research. The laboratory develops technologies to predict, measure, and test the performance of construction materials, components, systems, and practices. The laboratory also investigates the scientific principles that govern the phenomena of fire, provides the knowledge base for fire safety, develops the underlying technical support for new fire safety standards, and generates the engineering methodology to support the practice of fire protection engineering. NIST studies the concept of green buildings to meet users' needs and exploit the most advanced thinking in design and engineering while using energy efficient and environmentally sound processes and materials. In cooperation with industry, NIST is developing measurement methods to define the performance of advanced building environmental systems for use in a wide range of structures.

NIST has specifically authorized responsibilities in the areas of fire and earthquake engineering. In fire, the Building and Fire Research Laboratory is the foremost fire research laboratory in the United States. Building on numerous NBS/NIST fire safety studies since 1904, the modern program was established by the Federal Fire Prevention and Control Act of 1974 to reduce the human and economic costs of unwanted fires by providing scientific and technical knowledge on all aspects of fire for the fire protection community. In the National Earthquake Hazards Reduction Program, established in response to the Earthquake Hazards Reduction Act of 1977, NIST is the principal agency for research and development to improve building codes and standards and practices for structures and lifelines. NIST has studied structural and fire safety systems performance in Hurricanes Andrew in August 1992 and Fran in August 1996, and in the January 17, 1994, Northridge, California, and the January 17, 1995, Kobe, Japan, earthquakes to identify needs and opportunities to improve the seismic performance of buildings, public works, and utilities. NIST has also conducted field studies on the performance of structures in the 1997 Jarrell, Texas, the 1998 Orlando, Florida, and Birmingham, Alabama, and the 1999 Oklahoma City, Oklahoma, tornadoes. Wind engineering research addresses the effects of windstorms on shelters for occupant protection from severe winds, debris impact research, windstorm damage documentation and economics, integrated testing for wind effects, retrofit of existing buildings, and wind erosion.

In the U.S. in 1997, there were 4,050 fire deaths, 83 percent of which occurred in homes. On a per capita basis, the U.S. fire death rate of 18.8 per million is among the worst of industrialized nations. On a GDP basis, the direct cost of fires in 1997 was \$8.5 billion. The total direct and indirect cost of fire loss and fire protection is increasing in real terms, burdening the economy at over \$128 billion per year. A recent evaluation of the economic impacts of the use of NIST's Fire Safety Evaluation System, which is used to find more economical fire safety retrofits than allowed by prescriptive standards, shows savings of \$1 billion in hospitals and nursing homes from a research investment of \$4.5 million.

Construction is one of the Nation's largest industries. In 1998, new construction amounted to \$657 billion. Constructed facilities shelter and support most human activities. Their quality affects the competitiveness of U.S. industry and the safety and quality of life

of all people. When renovation, maintenance and repair are included for all construction sectors, the total value of construction work done amounts to more than a trillion dollars (i.e., \$1.06 trillion in 1998), or 12.2 percent of GDP. The construction industry employed 8.5 million workers in 1998, or about 6.5 percent of total U.S. employment. Employment in construction increased by 20 percent between 1992 and 1998 (Sources: Current Construction Reports; C30 Series; Census Bureau and Labor Force Statistics from Current Population Survey).

Construction and fire safety comprise a giant but disaggregated industry dominated by small enterprises. Private sector research is limited to development of proprietary products. Shortages of capital for R&D, inadequate interfaces among diverse products and practices, liability concerns, and regulations are barriers to innovation. The NIST program removes technological market barriers and reduces burdens of unnecessary or ineffective regulations while maintaining essential levels of safety. Private sector R&D is stimulated by this program's authoritative, nonprescriptive performance measures for construction and fire safety of materials, components, systems, and practices. It is the principal source of technical information for construction and fire safety standards, which, in turn, are widely used in fire and building codes.

The FY 2001 base program operating objectives include the following:

- Develop interface protocols for the transfer of information from construction site measurements to design databases for steel frame construction. Five to ten percent cycle time reductions are possible through the use of integrated information technology and are critical to the competitiveness of the U.S. construction industry.
- Demonstrate Cybernetic Building System (CBS) technologies, including load aggregation, fault detection, diagnostics, and utility/building communication, in the Phillip Burton Federal Building (PBFB) in San Francisco, the largest federal building west of the Mississippi River. A successful demonstration will lead to the widespread adoption of CBS technologies in both private and government-owned commercial buildings.
- Demonstrate the enhanced performance of the first prototype thermoplastic and thermoset polymer-layered silicate nanocomposites that reduce heat release rates significantly without environmental consequences. New approaches are needed for U.S. products to meet pending international flammability and environmental requirements.
- Develop measurement technologies for spray characteristics of fire sprinklers. This will address the sprinkler industry's critical need to evaluate and predict the performance of their sprinkler systems under actual fire conditions for use in industrial fire simulation systems.

- Develop a new computer program for evaluating the cost effectiveness of high-performance concrete (HPC) in highway bridge deck applications accounting for all major degradation mechanisms. The program will incorporate a life-cycle cost model and provide an essential tool for assisting highway engineers in reducing the life-cycle costs of concrete bridge decks.
- Complete standard guides for specifying and evaluating the structural safety and serviceability, durability, functionality, indoor atmosphere, and economic performance of single family attached and detached dwellings. These guides will accelerate the introduction of innovative U.S. housing technologies in both domestic and international markets.
- Develop and experimentally validate a computer model for predicting the depletion rate of ultraviolet (UV) stabilizers in paints and coatings. Such a model will provide improved understanding of factors affecting the service life of paints and coatings containing UV stabilizers and result in much more durable products for a wide range of building applications.
- Develop and experimentally validate a computer model for predicting the thermal and electrical performance of building integrated photovoltaic systems. This model will accelerate the introduction of photovoltaics into the building sector which currently accounts for 36 percent of the energy consumed within the U.S.
- Analyze the performance of structural systems which integrate the use of control devices to improve structural response to extreme loads. This will enable the effective use of control devices to minimize structural damage by optimizing the device characteristics and control strategy for a given structural system.
- Develop a comprehensive computer model for moisture transfer in firefighter protective clothing. Moisture content in the permeable and impermeable material layers is currently not considered in current models of clothing performance and is known to have a substantial influence on heat transfer and burn injury to firefighters. The textile and clothing industries will use this for the development of new concepts and materials.

Performance Measures
(All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the General Statement.

The NRC Assessment Panel for BFRL met on March 10-12, 1999, and has provided the following findings: “The technical merit of the work performed in the BFRL is very high. The current array of programs supports the laboratory’s mission and contributes to the U.S. effort to meet the national construction technology goals for research and development, which include reduced operation, maintenance, and energy costs and increased health and safety. Overall, the laboratory has world-class researchers that exhibit great enthusiasm and dedication.” The full report of the Panel’s findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: <http://www.nap.edu/books/NI000763/html>.

The NRC Assessment Panel for the Building and Fire Research Laboratory will meet again on March 9-10, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratory’s facilities, equipment, and human resources.

The Building and Fire Research Laboratory will initiate a new economic impact study of the Laboratory’s research on the industrial fire simulation system. This study will complement last year’s study of the potential economic impact of computer-integrated construction environments as well as four previously completed studies, which assessed the economic impact of BFRL’s research on roofing material, data for fire safety evaluation, ASHRAE standard 90-75 on energy conservation, and cybernetic building systems. The studies determined benefit-cost ratios of 11,000:1,¹ 126:1,² 2,500:1,¹ and 7.9:1,³ respectively, with benefits including development and implementation of more cost effective building materials, lower cost building methods for Life Safety Code compliance, energy conservation in buildings, and cost savings from the use of cybernetic building systems in office buildings.

¹ Chapman, Robert E., and Fuller, Sieglinde K., Benefits and Costs of Research: Two Case Studies in Building Technology. NISTIR 5840, Gaithersburg, MD: National Institute of Standards and Technology, 1996.

² Chapman, Robert E., and Weber, Stephen F., Benefits and Costs of Research: A Case Study of the Fire Safety Evaluation System. NISTIR 5863, Gaithersburg, MD: National Institute of Standards and Technology, 1996.

³ Chapman, Robert E., Benefits and Costs of Research: A Case Study of Cybernetic Building Systems. NISTIR 6303, Gaithersburg, MD: National Institute of Standards and Technology, 1999.

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Scientific and Technical Research Services
 DECREASE FOR FY 2001
 (Dollar amounts in thousands)

		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/(Decrease) Over 2001 Base</u>	
		<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Building and fire research	Pos./Approp	100	\$15,248	100	\$13,888	0	(\$1,360)
	FTE/Obl.	104	15,292	104	13,932	0	(1,360)

Wind Research (BA -\$1,360,000, Direct Obligations -\$1,360,000,) - This decrease recognizes the conclusion of a disaster research program on the effects of windstorms on protective structures and other technologies.

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
 (Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Building and fire research

Program Change: Building and fire research

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$0
11.9 Total personnel compensation	0
12.1 Civilian personnel benefits	0
21 Travel and transportation of persons	0
22 Transportation of things	0
23.3 Communications, utilities and miscellaneous charges	0
24 Printing and reproduction	0
25.1 Advisory and assistance services	0
25.2 Other services	0
25.3 Purchases of goods and services from Government accounts	0
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	0
26 Supplies and materials	0
31 Equipment	0
32 Land and structures	0
41 Grants, subsidies and contributions	(1,360)
99 Direct obligations	<u>(1,360)</u>

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Building and Fire Research
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY 2001 <u>Estimate</u>
Department of Defense			
Air Force	\$78	\$65	\$80
Army	88	75	80
Navy	106	120	150
Other	<u>876</u>	<u>889</u>	<u>890</u>
Subtotal, Department of Defense	1,148	1,149	1,200
Department of Agriculture	15	15	25
Department of Commerce	0	250	250
Department of Energy	2,188	2,280	2,400
Department of Health & Human Services	202	235	270
Department of Housing & Urban Development	1,319	2,644	2,800
Department of the Interior	816	861	830
Department of Justice	0	120	130
Department of Labor	168	61	100
Department of Transportation	714	885	920
Department of the Treasury	24	50	75
Department of Veterans Affairs	38	35	35
Environmental Protection Agency	103	57	60
Federal Emergency Management Agency	259	350	380
General Services Administration	27	205	180
National Aeronautics & Space Administration	419	490	510
National Science Foundation	30	0	0
Nuclear Regulatory Commission	90	135	150
Other	<u>16</u>	<u>100</u>	<u>105</u>
Total, Other Agency	7,576	9,922	10,420
Standard Reference Materials	20	0	0
Technical & Advisory Services	1,492	1,500	1,615
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>0</u>
Total, Other Reimbursables	1,512	1,500	1,615
Grand Total, Reimbursable Program	9,088	11,422	12,035

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

		1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
		Actual		Currently Available		Base		Estimate			
<u>Line Item</u>		<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>	<u>Per-</u>	<u>Amount</u>
		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>		<u>sonnel</u>	
Computer science and applied mathematics	Pos./Approp	337	\$43,759	330	\$44,232	330	\$45,347	352	\$56,347	22	\$11,000
	FTE/Obl.	339	42,479	338	45,267	339	45,551	355	55,751	16	10,200

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Computer science and applied mathematics										
Direct obligations		0		0		0		\$800		\$800
Reimbursable FTE/Obl	<u>72</u>	<u>\$8,721</u>	<u>74</u>	<u>\$13,847</u>	<u>74</u>	<u>\$13,841</u>	<u>68</u>	<u>13,841</u>	<u>(6)</u>	<u>0</u>
Total	72	8,721	74	13,847	74	13,841	68	14,641	(6)	800

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
COMPUTER SCIENCE AND APPLIED MATHEMATICS

Goal Statement

The goals of this subactivity are to (1) develop and demonstrate tests, evaluation techniques, testing methods, and standards to enable usable, reliable, secure and interoperable computer and telecommunications systems; (2) identify, compare, and contrast interoperability models based on realistic problems in various interoperability contexts; (3) increase security and privacy of Federal computer systems; and (4) provide leadership and collaborative research in the application of mathematics, statistics, and computers to science and engineering. The Computer Science and Applied Mathematics subactivity supports these goals by providing leadership and research in the development of tests and test methods and other evaluation techniques for computers and telecommunications systems; by providing support to scientists and engineers in theoretical and experimental investigations of emerging technologies that require advanced mathematical, statistical, and computational methods; by conducting joint research with industry, universities, and other NIST laboratories and Federal agencies; and by promoting the development and use of interoperable, scalable, secure and reliable computer and telecommunications systems through leadership and research to accelerate the adoption of new technologies. This work also supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

Through this subactivity, NIST conducts research and provides technical support in the development and use of computer and related telecommunications systems by (1) expanding research and development programs that will accelerate the utilization of new technologies; (2) expediting test development and measurement methods and capabilities for enhancing the interoperability, security, scalability, and usability of systems; (3) developing test methods and tools that will be employed by industry and users to measure the capabilities and performance of hardware, software and communications protocols and interfaces; (4) developing critically needed methods to secure and protect information resources in computer and telecommunications systems; and (5) ensuring that the best and most appropriate techniques in mathematical

modeling, statistics and numerical analysis and scientific computing are used by NIST staff and their collaborators in industry. This program affects both producers and users of information technology and telecommunications systems.

The U.S. information technology (IT) sector (computer, communications, software, and related information industries) contributes approximately \$680 billion to GDP per year and employs about 7.4 million people. NIST's contributions to the IT sector are precompetitive and generic, focus on technologies and standards that will have a large market payoff for U.S. industry, and promote U.S. industry's products in the global marketplace. NIST's programs focus on measurement science for information technology in the form of test methods and tests, computer science and engineering methodologies that underpin metrology for IT, and creation of open testbeds for industrial collaboration.

Innovations in computer hardware, software, and digital communications challenge managers to apply new technology for productivity increases throughout the U.S. economy in the coming years and will have pervasive effects on industry structure as well as on the quality of government services. The merging of computer and telecommunications technology heightens the importance of an integrated approach to the development and use of computer and communications systems. Information technology pervades almost all industries and organizations, enables new modes of conducting business and profoundly affects how companies around the world do business. With more demands to make information technology and its applications more effective and less costly, it is essential to overcome the barriers to the development of systems that are usable, scalable, interoperable, and secure. To this end, NIST participates with NSF, DARPA, NASA, NIH and others in the Information Technology for the 21st Century initiative and other components of the Computing, Information, and Communications R&D Program to foster partnerships among academia, industry, and government that will keep the U.S. at the cutting-edge of information and communications technologies.

In addition, NIST conducts programs that support the President's Critical Infrastructure Protection (CIP) Initiative which was implemented under the Presidential Decision Directive 63 and the July 1, 1997, Executive Office memorandum. NIST's programs will increase commerce and expand economic growth through the use of Internet and other computer-based communications by developing test methods and security services for infrastructure protection, data authentication and encryption, and data sharing. NIST will also play a crucial role in developing the technical standards and test and measurement methods to ensure the interoperability of the elements of electronic commerce.

Other programs supported in this subactivity have a substantial impact on the efficiency and productivity of all NIST laboratory-based programs and their interactions with users of NIST services in industry and other government agencies. Unique statistical methods developed in the program assure that NIST technical projects produce accurate, well-documented results. Specialized techniques in numerical analysis, mathematical modeling, and scientific computing allow scientists and engineers to exploit theoretical and experimental developments at the

forefront of science and technology. Direct involvement with the laboratory-based programs allows NIST mathematicians, computer scientists, and statisticians to identify needs common to many application areas and to develop special tools and methods to meet these needs.

The FY 2001 base program operating objectives include the following:

- Publish Advanced Encryption Standard (AES) Federal Information Processing Standard (FIPS) and guidance for Federal agencies on its use as the successor to the Data Encryption Standard, DES FIPS 46-2. This standard will provide significantly higher encryption security for use well into the next century.
- Extend the Public Key Infrastructure (PKI) testbed to include an integrated reference implementation of cryptographic services to support industry development of interoperable digital signatures and encryption applications.
- Complete the designs and prototypes for a software library of mathematical functions and continue development of application modules that support testing and evaluation of mathematical software and dissemination of related reference data sets for linear algebra, special functions, and statistics on the Web. These tools will meet the needs of algorithm and software developers.
- Develop tools to evaluate the performance of various technologies proposed for future generation wireless communication systems, including video over multi-path fading channels and Mobile Ad hoc Networks (MANET). Industry will use these tools to evaluate new wireless communications standards.
- Develop, extend and disseminate standard reference data and guidelines for emerging biometric authentication techniques, including facial data. Improve the security and usability of fingerprint information by developing a standard interface between fingerprints and digital signature standards. Advanced biometrics supports the needs of law enforcement and security access designers.
- Develop and extend multilingual versions of existing spoken language technologies benchmark tests in each domain of study, develop larger test sets, and develop metrics for assessing search results for multimedia information. These efforts enhance the execution of tasks and extend the application of human-computer interaction technologies beyond simple dictation systems to translation of new languages, vocally directed query of multi-lingual databases, and other mixed modes of interaction with computers.
- Initiate efforts to integrate multi-domain human-computer interactions technologies into a laboratory to demonstrate “smart-workspaces” and to promote standardization of critical interface technologies. These efforts support development of a multi-media conference room

environment where dialog can be automatically transcribed, speakers identified, and synchronized with video images of speakers and their presentations.

- Provide conformity assessment methods to ensure consistency with and accurate use of the XML (Extensible Markup Language) computer language specification. Industry needs the test methods and tools to assess and assure interoperable products for XML.
- Extend the application of Bayesian statistical methods to significant NIST problems in calibration, certification of reference materials, and software conformance testing to facilitate NIST researchers' work in complex problems and to better reflect the way scientists think about evidence. Evaluation methods based upon Bayesian statistical testing methods promise more reliable and robust software in the marketplace and less uncertainty in product calibrations.
- Conduct research and development that support efforts to improve the Java language and the numeric support environment for scientific computing including review proposed extensions, and complete definition of Java with numeric support and application program interfaces standardization. This effort will provide a new standard for numeric computations in Java that meet industry's objective of having a computationally efficient and accurate means of representing floating point computations.

Performance Measures
(All Sources of Funding)

Data on Measurement and Standards Laboratories (MSL) capability benchmarking and output metrics are provided in the General Statement.

The NRC Assessment Panel for ITL met on February 16-18, 1999, and has provided the following findings: "Overall, the panel found that the technical work under way in the ITL was of high quality and that projects are appropriate and well aligned with the laboratory and division missions. This laboratory services a broad range of customers through three essentially different types of activities: research related to measurements and standards for information technology, collaborations with other NIST laboratories in mathematics, statistics, and computational science, and technical infrastructure support services, such as maintenance of computer hardware and networks on the NIST campus. The ITL works hard to fulfill the diverse demands of its mission and is making progress on appropriately integrating the various components of the laboratory into a coherent whole that can take full advantage of the potential synergies among the wide range of expertise residing within the ITL." The full report of the Panel's findings for FY 1999 can be obtained from the National Research Council, Commission on Physical Sciences, Mathematics, and Applications, Board on Assessment of NIST Programs. The report also can be viewed on the NRC website at: <http://www.nap.edu/books/NI000763/html>.

The NRC Assessment Panel for the Information Technology Laboratory will meet again on February 23-24, 2000, to focus on the following topics:

- the technical merit of the laboratory programs relative to the state-of-the-art worldwide;
- the effectiveness with which the laboratory programs are carried out and the results disseminated;
- the degree to which the laboratory programs are meeting the needs for which they are intended; and
- insofar as they affect the quality of the technical programs, the adequacy of the laboratory's facilities, equipment, and human resources.

The Information Technology Laboratory recently initiated two economic impact studies focusing on the Data Encryption Standard and role-based access control for computing and information resources.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

	2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Computer science and applied mathematics Pos./Approp	330	\$45,347	352	\$56,347	22	\$11,000
FTE/Obl.	339	45,551	355	55,751	16	10,200
CIP research and development Pos./Approp			8	5,000	8	5,000
FTE/Obl.			6	4,500	6	4,500

Critical infrastructure protection (CIP) research and development (+8 Permanent Positions, +6 FTE, BA +\$5,000,000, Direct Obligations +\$4,500,000, Transfer to WCF +\$500,000) – To develop new tools to better protect information technology elements of the Nation’s critical infrastructures through research and development of new measurements, standards, test methods, and guidelines that identify and remedy vulnerabilities to natural or intentional disruptions. This initiative supports Presidential Decision Directive (PDD) #63 guidelines on critical infrastructure protection that “the Federal government shall, through its research, development and procurement, encourage the introduction of increasingly capable methods of infrastructure protection.” Through this initiative, NIST will focus on: information technology (IT) security management; advanced cryptography; development and dissemination of best security practices for both the public and private sectors; and protection of supervisory control systems used to monitor and control manufacturing, utilities, and building environments. NIST will use its close ties with industry and universities to conduct and disseminate CIP research and development (R&D), recognizing that “elimination of our potential vulnerability requires a closely coordinated effort of both the public and private sector” as stated in the PDD. This work also supports the DoC Secretarial priority on Establishing Safeguards Against Unconventional National Security Threats.

Problem Magnitude and NIST Role:

The economic and military security of the U.S. increasingly depends on complex critical infrastructures and information technologies that are essential to ensure continued operations of the economy and government. These critical infrastructures include telecommunications, utilities, banking and finance, manufacturing, health care, transportation, retail and wholesale trade, emergency services, and other infrastructures in both the private and public sectors. These infrastructures are increasingly automated and interlinked through advances in information technology (IT), which greatly improves efficiency and performance, but also creates new vulnerabilities. The widespread interconnectivity means that one or more critical infrastructures can potentially be disrupted by single point damage (e.g. to a network or critical computer) from cyber attacks, natural causes, human error, or equipment failure. For example, a local power plant disaster in Texas can severely impact the entire Northeast's ability to meet its energy requirements.

Cyber threats and cyber terrorism are becoming more appealing to U.S. enemies in the face of overwhelming U.S. military superiority and the relatively low cost and low risk of cyber attacks compared to physical attacks. Top quality R&D is needed to develop crucial IT security systems, methods, and products that are unlikely to be developed by the private sector.

NIST has the technical expertise and mission to conduct R&D to improve critical infrastructure protection. NIST's core mission includes developing and disseminating standards, measurements, and testing methods for technologies of all kinds, including IT and infrastructure protection. NIST has published many critical documents describing state-of-the-art security plans, programs, policies, training, and best practices. NIST has a long and successful record in cryptography R&D and is serving as the Nation's arbiter for the next generation of advanced encryption standards. NIST is a world-leader in R&D on supervisory system applications used to control processing in major industrial applications and digital control systems employed in networks for managing building environments, including building security. With its world-class R&D facilities, technical expertise, and recognition as an unbiased technical facilitator, NIST is uniquely positioned to facilitate national and international collaborations involving IT security and infrastructure protection technologies.

NIST is widely recognized throughout the government as a leading provider of IT security and infrastructure protection R&D and guidance. The Computer Security Act of 1987, the Clinger-Cohen Act, and executive responsibilities under OMB Circular A-130, Appendix III *Security of Federal Automated Information* (1996), all mandate NIST to address computer security issues. The

President's Commission on Critical Infrastructure Protection stated clearly its position that NIST must increase its leadership and research in providing technology and guidance for infrastructure protection for both the private sector and Federal agencies. NIST is uniquely qualified to establish vendor-neutral testbeds and demonstration facilities for rapidly evolving information technologies.

National needs for CIP are extensive, and NIST will be able to address only a fraction of those needs through this initiative. NIST will focus on its areas of existing expertise and on areas where investment of limited resources can be expected to have the greatest impact on improving CIP.

Proposed NIST Technical Program:

At the proposed funding level, NIST will develop CIP R&D programs in four IT-related areas:

- cryptography
- security management
- best security practices
- security of supervisory control systems

Cryptography: NIST will provide guidance to the private and public sectors on cryptographic solutions, including specifying a model incorporating good security practices and the development of a prototype infrastructure to assess the effectiveness of the model. The model will address such cryptographic issues as security policy and procedures, Public Key Infrastructure (PKI) considerations, trust management, key management, cryptographic algorithms, recoverability, availability, maintainability, access control, authentication, and validation testing.

Security management: NIST will develop specialized guidance in security engineering and system architecture by developing model protection profiles and security architectures which have broad applicability to the Federal government and are consistent with new and emerging technical and business areas (e.g. virtual private networks, e-commerce, etc.).

Best security practices: The President's Commission on Critical Infrastructure Protection Report, the GAO, OMB and other Federal agencies are calling on NIST to provide more best security practices technical guidelines for use by Federal agencies and industry. This work will support efforts of industry and the U.S. government to improve private and public sector IT security, support the IT security industry, and support the national critical infrastructure protection initiative. NIST will build on its existing publication base of best security practices and guidance based on emerging technologies. NIST will provide agencies with timely advice about security issues that may arise from the use of best practices as specified in OMB Circular A-130, Appendix III. NIST will collaborate with

members of the Computer Security Program Managers' Forum, CIO Security Sub-Committee, and other forums, taking advantage of expertise within the Federal government, the private sector, and academia.

Security of Supervisory Control Systems: NIST will develop and disseminate measurements, standards, and best practices for ensuring the security of supervisory control systems used to regulate manufacturing and process control, to ensure generation and delivery of water and electric power, and to ensure the safety and environmental control of buildings. These IT systems are often overlooked in discussions of CIP, but are crucial to maintaining normal functioning of the economy and of government, and ensuring the health and safety of millions of citizens at work, at home in apartments, and in large public buildings. For example, security of building control systems is crucial to combating terrorist attempts to injure or kill thousands of people in buildings such as the World Trade Center.

NIST programs in supervisory control system security will include:

- Development of control system security standards driven by task groups organized by major industry groups. Such standards will help ensure improved prevention of failure due to intrusion or natural causes, early detection of intrusions and failures, and survivability of systems in the face of disruptions.
- Expansion of the BACnet (building automation control network) protocol beyond current limited use for HVAC (heating, ventilating, and air conditioning) applications to full control of building systems, including fire and hazard detection, energy utilization controls, and automated communications with outside service providers.
- Development of an enhanced testbed (based on NIST's Virtual Cybernetic Building Testbed) to study security issues associated with cybernetic building systems to accelerate development and adoption of new building services while improving security of building systems.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Critical Infrastructure Protection (CIP) Research and Development Initiative	
Technical Area	Outputs
Cryptography	<ul style="list-style-type: none">• Implement Public Key Infrastructure (PKI) prototype.
Security Management	<ul style="list-style-type: none">• Publish one model protection profile per year.
Best Security Practices	<ul style="list-style-type: none">• Publish one technical guideline per year.• Publish one technical report per year.
Security of Supervisory Control Systems	<ul style="list-style-type: none">• Expand BACnet protocol – BACnet extensions developed for security systems, and for interfacing building control systems with outside service providers.• Establish enhanced Virtual Cybernetic Building Testbed that will support testing and evaluation of security concepts/systems.• Develop test methods to measure the effectiveness of manufacturing supervisory control system security features.

Performance Measures: Outcomes

Successful completion of the work described in this initiative will help protect the Nation against economic loss and loss of life related to disruption of critical government and private sector services, including:

- Avoidance of catastrophic single-infrastructure failure or catastrophic multiple-infrastructure failure. This includes losses based on physical and cyber terrorism, as well as failures due to human error or equipment failure;
- Reduction of the level of ongoing loss (fraud, waste, and abuse) through lower-level attacks and failures in the information and communications infrastructure;
- Productivity enhancements, improved cost effectiveness, and reduced operational and maintenance costs due to fewer failures within critical information infrastructures;
- Assurance of continued functioning of supervisory systems controlling manufacturing equipment in the automotive, aerospace, electronics, chemical, and other industries; and
- Assurance of continued functioning of supervisory systems that coordinate and control the safe and effective production and distribution of water and electrical power.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

Program Change: CIP research and development

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer scientist	ZP V	4	84,530	338,120
Computer specialist	ZP V	4	84,530	338,120
Subtotal		<hr/> 8		<hr/> 676,240
Less lapse	25 %	(2)		(169,060)
Total full-time permanent (FTE)		<hr/> 6		<hr/> 507,180
2001 Pay Adjustment (3.7%)				18,766
Total				<hr/> 525,946
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		6		
Authorized Positions:				
Full-time permanent		8		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

Program Change: CIP research and development

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$526
11.9 Total personnel compensation	526
12.1 Civilian personnel benefits	129
21 Travel and transportation of persons	95
22 Transportation of things	41
23.3 Communications, utilities and miscellaneous charges	147
24 Printing and reproduction	34
25.1 Advisory and assistance services	0
25.2 Other services	2,947
25.3 Purchases of goods and services from Government accounts	240
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	61
26 Supplies and materials	129
31 Equipment	151
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 4,500
Transfer to NIST Working Capital Fund	500
Total increase requested	<hr/> 5,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

	2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
	Personnel	Amount	Personnel	Amount	Personnel	Amount
Computer science and applied mathematics Pos./Approp	330	\$45,347	352	\$56,347	22	\$11,000
FTE/Obl.	339	45,551	355	55,751	16	10,200
CIP expert review team Pos./Approp			11	5,000	11	5,000
FTE/Obl.			8	5,000	8	5,000

Critical infrastructure protection (CIP): expert review team (ERT) (+11 Permanent Positions, +8 FTE, BA +\$5,000,000, Direct Obligations +\$5,000,000) - To establish a team of computer security experts to help Federal agencies protect their information systems in accordance with Presidential Decision Directive (PDD) #63 on critical infrastructure protection, applicable statutes, and OMB guidance. PDD #63 identifies the Federal government as one of the critical infrastructures requiring protection to ensure continued functioning of government, society, and the economy in the face of natural, inadvertent, or purposeful disruptions. The Expert Review Team will help Federal agencies identify and fix existing vulnerabilities in information systems and assist agencies in preparing for future security threats. The initiative includes a one-time \$3 million operational fund to help agencies fix the most pressing security vulnerabilities identified by the team. This work also supports the DoC Secretarial priority on Establishing Safeguards Against Unconventional National Security Threats.

Problem Magnitude and NIST Role:

Interdependent information technology (IT) infrastructures are increasingly critical to the IT-driven economy and to continued functioning of the Federal government. For example, the Federal government relies on complex IT systems to ensure military security, enable financial transactions, store and disseminate information, permit timely communications, and conduct essentially all government functions. The Nation is at risk from disruptions of critical government IT services due to natural disasters, human error,

equipment failures, and purposeful attack—including both cyber-terrorism and physical attacks. PDD #63 recognizes that Federal government IT systems are a critical infrastructure requiring protection from natural and purposeful disruptions to ensure that essential government services are not interrupted or can be quickly reconstituted following disruptions. The government IT infrastructure includes computers, networks, related equipment, and software.

In addition to making systems more robust against natural disasters, equipment failure, and human error, a crucial component of Federal IT infrastructure protection is strengthening systems to better resist attempted cyber-terrorism or quickly recover from security breaches. Nearly all Federal IT systems are subject to constant intrusion attempts launched from worldwide sites, and the security of Federal IT systems has been breached many times (although fortunately not yet with disastrous consequences). Increasing U.S. military superiority and the relative ease and low expense of conducting cyber attacks suggest that cyber threats will continue to grow. The U.S. is currently vulnerable to broad disruptions in services through relatively small attacks or failures. For example, three days before the President issued PDD #63, the malfunction of a single telecommunications satellite silenced 45 million pagers in the U.S. and severed electronic links vital to thousands of retailers and broadcasters. While this disruption involved civilian IT infrastructure and did not affect critical government services, government IT infrastructure is similarly vulnerable to disruption with potentially much greater consequences for the Nation.

Critical infrastructure protection and IT security issues are complex and rapidly evolving. Very few government agencies have the resources to fully evaluate the vulnerabilities of their IT systems to attack or disruption and to implement appropriate preventive measures. The Expert Review Team at NIST will serve a government-wide need of providing state-of-the-art vulnerability assessments and advice on improving IT security. The ERT will draw both on NIST's existing expertise in IT security and infrastructure protection and facilitate exchange of the best information and best security practices among government agencies and between government and the private sector. The ERT will also help realize the PDD #63 goal of making the government the model for U.S. critical infrastructure protection in the IT sector.

NIST is well positioned to help government agencies identify and fix IT systems vulnerabilities. NIST computer scientists and engineers are recognized as world leaders in all aspects of IT security issues—from the performance of physical networks to computer security to advanced encryption standards. NIST's mission emphasizes working with industry to develop and apply technology, measurements, and standards of all types—including IT—which has given NIST long and extensive experience in working with customers to identify their technology needs and provide appropriate solutions. This experience makes NIST well-qualified to work with diverse Federal agencies to assess IT systems vulnerabilities and prescribe needed security fixes. NIST's close ties with industry will also facilitate exchange of IT CIP information between the government and private sector to the advantage of all parties.

Proposed NIST Technical Program:

With the proposed funding level, NIST will establish an Expert Review Team based at NIST to assist Federal agencies with protecting critical IT systems by identifying vulnerabilities and recommending actions to minimize disruptions from natural causes, equipment failure, human error, and cyber threats. NIST will form a team of leading national experts on a wide range of IT security issues. The team will continually consult with private sector and government IT security professionals to ensure the best and most recent skills and knowledge are available to protect government IT resources. The team will be augmented by detailees from other agencies to both extend the reach of the team and to ensure optimal exchange of information and technologies among agencies. The initiative also provides a one-time \$3 million operational fund for NIST to assist in the repair of the most critical vulnerabilities identified in FY 2001.

IT system security may be compromised in many ways. Two important threats include intrusions by authorized (inside) users of the system or outside hackers and flaws in software design, integration, or implementation. NIST has long developed measurements, testing methodologies, and standards needed to help ensure the reliability, trustworthiness, and survivability of IT systems supporting critical national infrastructures. The ERT will provide expert advice to Federal agencies in many aspects of IT security, including:

- **Security Technology:** Security technology is an enabler for the entire IT infrastructure that is used to prevent and detect intrusions. Several basic security technologies comprise the building blocks of any secure, survivable system. Principal among these technologies are: cryptography, identification/authentication, and public key infrastructure (PKI). The ERT will provide agencies with guidance in algorithm identification and selection, digital signature methods, and the application of cryptographic technology to protect the reliability and integrity of networks and components.
- **Security Management:** The assessment of risks, selection and implementation of appropriate technologies, and ongoing management of security controls is a complex but critical process. The ERT will help agencies continuously review and update their IT security systems to keep pace with changing technology and threats.
- **Application of Best Security Practices:** The Federal government and the private sector have accumulated substantial experience and knowledge in the design and implementation of computer security measures. However, this expertise is often not shared among organizations, resulting in tremendous inefficiency and "re-invention of the wheel." A key role of the ERT will be to facilitate sharing of best security practices among government agencies and between the government and private sectors.

- **Intrusion Detection:** Early detection of intrusions is critical to limiting damage to Federal IT systems and ensuring that agencies can rapidly recover from attacks. The ERT will help agencies acquire and use the latest equipment and software for intrusion detection and analysis to strengthen their overall IT security systems.
- **Incident Response:** Agencies are now required to establish and maintain credible capabilities to identify and respond to the increasingly immediate and high-impact threats resulting from the Internet and other highly interconnected systems. The ERT will help agencies assess their incident response needs and implement appropriate programs.
- **System Survivability:** Even with the best security technology, the U.S. must expect failures of IT security in the face of determined and competent adversaries. The ERT will provide agencies with guidance in how to respond to, and (if necessary) recover from anomalous or threatening events or conditions. Application of several key technologies, including system assurance methods, fault tolerance technology, key management and secure domain name services, anomaly and suspicious event detection, automated response mechanisms, and activators capable of reconfiguring compromised components, can enhance the survivability of critical systems. Products are able to identify known vulnerabilities, detect intrusions, initiate warning and response procedures, and "plug" security holes. This same technology must be extended for use in very large-scale, high criticality systems and networks that support critical infrastructures. The ERT will help agencies best use existing security products and adopt new techniques to ensure system survivability.

Performance Measures: Outputs

At the proposed funding level, NIST will produce the following outputs:

Critical Infrastructure Protection – Expert Review Team Initiative	
Outputs	
<ul style="list-style-type: none"> • Consult with Federal agencies on sensitive and critical systems. • Review agency CIP plans for key systems. • Conduct vulnerability assessment of Federal agency IT systems. • Assist in reviewing implemented security measures for appropriateness and effectiveness. • Issue best practices technical guidelines, technical reports, and other guidance documents. • Conduct computer intrusion drills. • Provide technical support for emergency security fixes. 	

Performance Measures: Outcomes

At the proposed funding level, successful completion of the work described in the initiative will:

- Help protect the Nation against economic loss or injury to citizens related to disruption of critical Federal systems;
- Increase Federal agency understanding of security vulnerabilities and identification of appropriate counter-measures;
- Improve Federal agency planning for CIP activities; and
- Increase Federal agency implementation of appropriate CIP plans.

In addition, advancements in infrastructure protection can reduce the level of ongoing loss by lower-level attacks (fraud, waste, and abuse) and IT security failures. In one recent study (Computer Security Institute report, *Issues and Trends: 1998 CSI/FBI Computer Crime and Security Survey*), it was estimated that “computer crime” resulted in \$137 million in combined losses for 241 surveyed organizations (corporations, government agencies, financial institutions, and universities) over a 24-month period ending in early 1998. Extrapolating these losses to the entire economy, it is evident that even a small reduction in losses to “computer crime” through increased security practices would have an enormous impact on the Nation.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

Program Change: CIP expert review team

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer scientist	ZP V	6	84,530	507,180
Computer scientist	ZP IV	4	71,861	287,444
Administrative/technical support	ZA II	1	35,265	35,265
Subtotal		<u>11</u>		<u>829,889</u>
Less lapse	25 %	(3)		(207,472)
Total full-time permanent (FTE)		<u>8</u>		<u>622,417</u>
2001 Pay Adjustment (3.7%)				23,029
Total				<u>645,446</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		8		
Authorized Positions:				
Full-time permanent		11		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

Program Change: CIP expert review team

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$645
11.9 Total personnel compensation	645
12.1 Civilian personnel benefits	158
21 Travel and transportation of persons	97
22 Transportation of things	17
23.3 Communications, utilities and miscellaneous charges	138
24 Printing and reproduction	14
25.1 Advisory and assistance services	0
25.2 Other services	3,556
25.3 Purchases of goods and services from Government accounts	78
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	30
26 Supplies and materials	143
31 Equipment	124
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 5,000
Transfer to NIST Working Capital Fund	0
Total increase requested	<hr/> 5,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

	2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
	Personnel	Amount	Personnel	Amount	Personnel	Amount
Computer science and applied mathematics .....Pos./Approp	330	\$45,347	352	56,347	22	\$11,000
FTE/Obl.	339	45,551	355	55,751	16	10,200
Information technology for the 21 st century .....Pos./Approp			3	1,000	3	1,000
FTE/Obl.			2	700	2	700

Information technology (IT) for the 21st century (+3 Permanent Positions, +2 FTE, BA +\$1,000,000, Direct Obligations +\$700,000, Transfer to WCF +\$300,000) - To provide measurements and standards supporting private sector development of advanced wireless technologies to ensure continued U.S. world leadership in information technology (IT). New measurement capabilities and standards are needed to enable U.S. industry to lead the transition of IT from technology based on desktop personal computers to a new paradigm of ubiquitous, networked and embedded computing connected by wireless links. This initiative will enable NIST to develop the measurements and standards infrastructure to support the emergence of new wireless information technologies. This work supports the White House priority on IT research and development and also supports the DoC Secretarial priority on Accelerating the Transition to Electronic Commerce.

Problem Magnitude and NIST Role:

New wireless networking and communications technology will be a critical enabler of the vast next generation IT market, and measurements and standards are needed to ensure that U.S. industry and our economy can remain world leaders in the future IT-driven global economy. The U.S. IT market currently contributes about \$680 billion to the annual GDP, is expanding, and is an important

enabler for other economic sectors. The importance of IT to the U.S. economy and quality of life will expand further as we rapidly enter the era of ubiquitous computing when computers become so small, inexpensive, and powerful that they are routinely used everywhere -- as integral parts of buildings, vehicles, factories, hospitals, homes, and almost every part of our lives. These ubiquitous computers will be linked together forming a distributed network with unprecedented power, spawning dramatic new applications. However, in the era of inexpensive ubiquitous computers, hardwired network connections will be more expensive than the computers themselves and will limit the mobility and connectivity of the computers. Industry hopes to overcome these limitations with new wireless networking technology. Next generation wireless technologies will impact not only communications, commerce, and government, but will also result in new paradigms for health care, public safety, education, law enforcement, manufacturing, and entertainment. But without proper measurement tools and standards, the new wireless technologies will develop more slowly and inefficiently, impeding U.S. economic and technology growth and risking the loss of market share and technology leadership to other nations in the highly competitive global marketplace.

NIST can provide the measurement and standards U.S. industry needs to develop new wireless products, services, and instrumentation, ensure quality, and compete internationally. NIST will conduct an integrated technical program to provide the critical measurements and standards infrastructure necessary to support wireless communication technologies. NIST is uniquely capable of addressing these critical needs along the entire industrial supply chain -- from materials producers to components suppliers to end-device manufacturers. Through this technical program, NIST will improve the productivity and quality of the wireless industry by providing the underpinnings of technology needed for next-generation materials and devices. NIST will work with industry to produce advanced metrology for characterization of materials performance at high microwave frequencies, as well as fundamental materials information needed for the successful design of next-generation devices with improved performance as well as reduced cost. NIST is the only organization that has the mission and the necessary combination of staff expertise, industry contacts, industry respect, and worldwide recognition as the leading measurement and standards institution.

Proposed NIST Technical Program:

At the proposed funding level, NIST will develop measurements, standards, and test methods to support the entire wireless industry supply chain. The wireless industry recognizes the need for technically strong standards to overcome interoperability problems and provide measurement support needed to develop new products. NIST will work with industry to develop the measurements and standards needed for emerging wireless technologies such as broadband (e.g. mobile Internet access, business services, digital video, etc.), and 3rd Generation (3G) cellular (multimedia cellular phone). NIST will continue to work in cooperation with the National Telecommunications and Information Agency to advance measurements and standards needed for wireless communications.

NIST will develop:

- Technical standards to ensure broad-based interoperability of wireless systems and components based on industry consensus;
- Measurement techniques, materials properties data, and standard reference materials to support the wireless components industry; and
- Advanced measurement techniques for characterizing antennas and microcircuits for a broad range of new wireless technology applications.

NIST technical activities will include:

- *Standards that facilitate the development of superior technology and its compatibility and acceptance worldwide, and facilitate new applications.* U.S. companies have been unsuccessful in standardizing wireless communications systems in the U.S. and in the world, because of their traditionally independent development of non-compatible products. Recent deregulation has led to the establishment of different wireless communication systems in this country that are neither interoperable with one another nor with those in other countries. As a result, the European Global System for Mobile Communication (GSM) dominates the global cellular market, leaving the U.S. wireless industry at a competitive disadvantage. NIST's program would build industry consensus for common interface standards based upon testing approaches designed to evaluate wireless components and systems fairly. It would also encourage industry to work collaboratively in developing systems and standards that allow all U.S. companies to compete in the domestic and global markets.
- *Critical measurements for advanced wireless components.* The demand for "smaller, cheaper, better" wireless products is driving U.S. manufacturers to try to develop exotic new devices and materials for wireless communications. Choosing, manufacturing, and testing the new materials and devices requires accurate measurement techniques and the development of new standards. Measurements, standards, and data are also needed to efficiently select new candidate materials and model performance of proposed devices without the expense and time of randomly trying different combinations and devices. NIST will develop broadly applicable measurement technology to characterize materials for performance in wireless devices and components, and to help industry improve their new product R&D. NIST will provide critically needed data and standard reference materials for magnetic and dielectric properties which determine wireless performance. NIST will develop new measurement capabilities to characterize anomalies in wireless circuits, antenna performance, and on-wafer properties of microelectronics devices used for wireless communications.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Information Technology (IT) for the 21st Century Initiative	
Technical Area	Outputs
Wireless Communications	<ul style="list-style-type: none">• Develop one new internationally recognized standard per year for broadband wireless network performance and interoperability.• Develop one new measurement method and one publication per year specifying the measurements for broadband or 3rd Generation cellular technology.• Develop one new standard reference material (SRM) and one publication per year specifying measurements for improved materials characterization.• Develop one ternary system diagram and one associated publication per year for ceramic processing diagrams with chemical mapping of dielectric performance (permittivity, loss, and temperature coefficient).• Publish one database per year (traceable to NIST) of the intrinsic dielectric and magnetic properties (permittivity, permeability, dielectric loss tangent, magnetic loss tangent, and temperature coefficients) of key materials over the frequencies needed by the wireless communications industry.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- Provide critically needed measurements and standards for wireless information technology, providing a competitive advantage to U.S. industry in the next generation of information technology driven by wireless communications.
- Enhance R&D efficiency, lower transaction costs, improve product quality, and raise productivity for the U.S. wireless communications and information technology industry.
- Improve the efficiency, mobility, and power, while lowering the cost of computing and communications through high-speed wireless networks.

Examples of the potential impact of this technology could include:

- Real time monitoring and remote medical treatment of patients using wireless technology to permit medical care of patients outside the hospital. Patients would retain freedom to remain at home or work as appropriate while receiving proper care, health care costs would be reduced by shortening or avoiding costly hospital stays, and quality of diagnosis and treatment would be improved by expanding the reach of top quality medical care providers.
- High-speed wireless Internet links available at all times and all places: in your car, in airplanes, through a pocket-sized digital device easily carried anywhere. The enormous cost of laying optical fiber or coaxial cable would be avoided, mobility of computing and communications would be dramatically improved, and the computing and networking power would be vastly expanded through a flexible system of wireless communications.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

Program Change: Information technology for the 21st century

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer scientist	ZP IV	1	71,861	71,861
Electrical engineer	ZP IV	2	71,861	143,722
Subtotal		<hr/> 3		<hr/> 215,583
Less lapse	25 %	(1)		(53,896)
Total full-time permanent (FTE)		<hr/> 2		<hr/> 161,687
2001 Pay Adjustment (3.7%)				5,982
Total				<hr/> 167,669
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		2		
Authorized Positions:				
Full-time permanent		3		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Computer science and applied mathematics

Program Change: Information technology for the 21st century

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$168
11.9 Total personnel compensation	168
12.1 Civilian personnel benefits	41
21 Travel and transportation of persons	16
22 Transportation of things	5
23.3 Communications, utilities and miscellaneous charges	40
24 Printing and reproduction	4
25.1 Advisory and assistance services	0
25.2 Other services	35
25.3 Purchases of goods and services from Government accounts	41
25.5 Research and development contracts	279
25.7 Operation and maintenance of equipment	13
26 Supplies and materials	23
31 Equipment	35
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 700
Transfer to NIST Working Capital Fund	300
Total increase requested	<hr/> 1,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Computer Science and Applied Mathematics
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Department of Defense			
Army	\$58	\$0	\$0
Navy	268	70	70
Other	<u>4,276</u>	<u>6,620</u>	<u>6,620</u>
Subtotal, Department of Defense	4,602	6,690	6,690
Department of Agriculture	16	22	23
Department of Commerce	651	845	719
Department of Energy	162	230	230
Department of Health & Human Services	208	175	175
Department of Justice	664	2,860	2,860
Department of Transportation	9	20	20
Department of the Treasury	694	286	286
Department of Veterans Affairs	192	474	400
Environmental Protection Agency	100	455	455
General Services Administration	891	269	269
National Aeronautics & Space Administration	80	394	394
National Science Foundation	0	500	800
Other	<u>270</u>	<u>500</u>	<u>450</u>
Total, Other Agency	8,539	13,720	13,771
Technical & Advisory Services	182	127	70
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>800</u>
Total, Other Reimbursables	182	127	870
Grand Total, Reimbursable Program	8,721	13,847	14,641

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Technology assistance

<u>Line Item</u>	1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
	Actual		Currently Availalble		Base		Estimate			
	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Technology assistance										
Pos./Approp	122	\$17,043	118	\$17,363	116	\$17,197	116	\$17,197	0	0
FTE/Obl.	123	17,624	124	17,708	122	17,349	122	17,349	0	0

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
 (Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Technology assistance

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Technology assistance										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>140</u>	<u>\$18,652</u>	<u>142</u>	<u>\$17,660</u>	<u>142</u>	<u>\$17,624</u>	<u>142</u>	<u>\$17,624</u>	<u>0</u>	<u>0</u>
Total	140	18,652	142	17,660	142	17,624	142	17,624	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
TECHNOLOGY ASSISTANCE

Goal Statement

The goals of this subactivity are to (1) overcome technical, non-tariff barriers to trade in international markets through analysis of and assistance with normative standards; provide technical expertise for the development of normative standards; accredit testing laboratories and train standards officials; (2) assure U.S. consumers of a fair domestic market by providing uniform and accurate measurements in trade in collaboration with the states' Weights and Measures Offices; and (3) support U.S. industry's development of competitive technologies by providing essential measurement services, standard reference materials, and standard reference data. This work supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

The programs under this subactivity provide a central source of information and leadership for U.S. industry regarding national and international standardization activities and issues concerned with conformity assessment, including product testing and certification. These programs also offer industry central access to standard reference materials, standard reference data, and calibrations, and thereby traceability to national and international standards of measurements.

NIST cooperates closely with national and international standards developers and analyzes standards, codes, and regulations. NIST operates the National Center for Standards and Certification Information and assists industry, government, and the public with detailed information on standards-related issues that increasingly affect trade. NIST monitors the work of nearly 120 standards committees and manages U.S. participation in the International Organization of Legal Metrology (OIML), especially with respect to those committees (nearly half of the total) in which U.S. government and industry representatives participate (or chair). In addition, NIST conducts a program aimed at enhancing the flow of international standards information to U.S. industry and promoting overseas adoption of U.S. standards technology. NIST acts as the lead agency in the national metric conversion effort by coordinating the metric transition activities throughout

the Federal government and serving as a home base for metric training and information dissemination for U.S. businesses and state and local governments.

NIST accredits calibration and testing laboratories by evaluating their technical qualifications and competence to perform certain types of calibrations and tests. These testing laboratories play an important role in conformity assurance for international trade and regulatory purposes. NIST is responsible for designing, implementing, and accrediting conformance testing in areas of calibration and major testing fields and subfields. Currently, about 800 laboratories are enrolled. The accreditation program is used by Federal, state, and local governments and by commercial manufacturers. This program is available to domestic and foreign laboratories to provide unbiased evaluation and recognition of testing performance.

In cooperation with the National Conference on Weights and Measures and the states' Weights and Measures Offices, NIST assures consumers fairness in the marketplace by establishing uniform and accurate measures used in trade. NIST also develops standardized test methods for measuring instruments used in trade; provides training for trade inspectors; writes manuals for weights and measures functions; and assures the technical validity of various laws and regulations governing packaged goods and measuring devices such as scales, gasoline pumps, taxi meters, and fuel oil meters.

Through this subactivity, NIST provides industry and government with access to its approximately 500 different physical and chemical calibration and measurement assurance programs; provides assistance to technical staff on physical and chemical measurement quality control and experiment design; evaluates the effectiveness of dissemination mechanisms; and provides a single point of contact for organizations outside of NIST which use these measurement services, including the National Conference of Standards Laboratories, the Calibration Coordination Group in the Department of Defense, and a broad range of commercial users.

NIST also provides a grant to the American National Standards Institute (ANSI) to strengthen U.S. representation in international standardization activities which is a critical part of NIST's investment in the international trade infrastructure and support for U.S. industry's competitiveness. ANSI is the U.S. representative to the two major non-treaty, international standards organizations, and it provides a strong advocacy for the use of U.S. standards and technology throughout the global market.

FY 2001 base program operating objectives include the following:

- Help U.S. industry overcome or avoid technical, non-tariff barriers to trade in major developing markets by promoting the use of U.S. technology and practices in foreign and international standards, and designing and implementing mutually recognized conformance assessment programs in close cooperation with the International Trade Administration.

- Overcome non-tariff barriers to trade by expanded training of trade officials from developing countries on the proper use of normative standards in trade, conformity assurance, product certification, accreditation of test laboratories, and physical and chemical metrology.
- Provide industry, governments, and the public with accurate physical, chemical, and engineering measurements through calibration services, standard reference materials, and standard reference data.
- Establish a worldwide system of uniform and accurate measurement standards to support U.S. exports. This work is closely coordinated with the International Bureau of Weights and Measures and with standards authorities in developing markets.
- Provide U.S. industry with detailed current standards and conformity assessment information for major foreign markets, e.g., Market of the Americas, North American Free Trade Agreement (NAFTA), European Union (EU), Asia Pacific Economic Cooperation (APEC), Commonwealth of Independent States (CIS), and others; provide U.S. businesses with advance information on planned changes in rules and regulations in all major markets.
- In cooperation with the states' Weights and Measures Offices, provide uniform and accurate measurements for retail and wholesale trade throughout the United States. This affects about \$4 trillion of retail and wholesale trade.
- Provide state weights and measures inspectors with training and manuals to assure a fair market for U.S. consumers.
- Seek international acceptance of National Type Evaluation Program Certificates of Conformance through the International Organization of Legal Metrology Pattern Approval Plan.
- Provide support to ANSI to promote its role of increasing U.S. representation in the development of international standards, thereby promoting acceptance of U.S. exports throughout the global market.

Performance Measures

Technology Services administers many of the programs from which the NIST-wide quantitative performance measures are obtained. These performance measures appear in the Executive Summary of this budget request.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Technology Assistance
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Department of Defense			
Air Force	\$155	\$109	\$109
Army	727	631	631
Navy	357	252	252
Other	<u>12</u>	<u>169</u>	<u>169</u>
Subtotal, Department of Defense	1,251	1,161	1,161
Department of Agriculture	71	79	79
Department of Commerce	81	94	56
Department of Energy	682	564	463
Department of Health & Human Services	0	266	266
Department of the Interior	64	45	45
Department of Labor	3	1	1
Department of Transportation	0	24	24
Department of Veterans Affairs	34	24	24
Environmental Protection Agency	0	23	23
National Aeronautics & Space Administration	0	270	270
National Science Foundation	20	14	14
Other	<u>11</u>	<u>14</u>	<u>5</u>
Total, Other Agency	2,217	2,579	2,431
Calibrations & Testing	2,150	2,342	2,276
Standard Reference Materials	6,810	5,606	5,666
Technical & Advisory Services	7,475	7,133	7,251
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>0</u>
Total, Other Reimbursables	16,435	15,081	15,193
Grand Total, Reimbursable Program	18,652	17,660	17,624

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: National quality program

<u>Line Item</u>		1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
National quality program											
	Pos./Approp	39	\$4,850	38	\$4,903	38	\$5,191	38	\$5,191	0	0
	FTE/Obl.	39	3,877	40	5,913	40	5,205	40	5,205	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: National quality program

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
National quality program										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>0</u>	<u>\$2,369</u>	<u>0</u>	<u>\$1,600</u>	<u>0</u>	<u>\$1,600</u>	<u>0</u>	<u>\$1,600</u>	<u>0</u>	<u>0</u>
Total	0	2,369	0	1,600	0	1,600	0	1,600	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
NATIONAL QUALITY PROGRAM

Goal Statement

The goal of this subactivity is to assist U.S. businesses and other organizations in continuously improving their productivity, efficiency, and customer satisfaction by adopting quality and performance improvement practices. This program also supports the DoC strategic goal to promote economic growth.

Base Program

The National Quality Program has as its foundation the Malcolm Baldrige National Quality Award (MBNQA), created by P.L. 100-107 in August 1987. In 1999, the award was expanded to include categories in health care and education as authorized by the Technology Administration Act of 1998 (P.L. 105-309). The Program has become a focal point for strengthening America's competitive position. The Baldrige Award has proven to be highly effective in stimulating interest in performance improvement, performance excellence, sharing and cooperation, and creation of new information networks within the business community and public benefit sectors.

NIST responsibilities under P.L. 100-107 and P.L. 105-309 are carried out by the Baldrige National Quality Program (BNQP). The Program continues to build key linkages with other organizations and provide limited educational outreach services. U.S. businesses and non-profit organizations throughout the country are now turning to NIST for leadership in performance improvement. The BNQP aims to improve its leadership as a focal point and educational resource for all U.S. organizations interested in improving their competitiveness and overall performance.

The program's design and operational strategy is three-fold: (1) to create a new kind of performance excellence standard that fosters communications and sharing among organizations of all types – business, health care, and education, as well as the public, will benefit; (2) to build networks and other key linkages to deliver performance and quality management, and competitiveness enhancement information and services locally throughout the U.S.; and (3) to build on the success of the present program by sharing lessons learned in the business,

health care, and education communities with other sectors of the economy thereby accelerating the process of performance improvement for those sectors.

The FY 2001 base program operating objectives for the Baldrige National Quality Program include the following:

- Implement the MBNQA competition, including examiner selection, examiner training, and application review, to provide services to applicants in business, health care, and education categories.
- Conduct the Quest for Excellence Conference at which MBNQA winners share their performance excellence strategies.
- Maintain a comprehensive database on state and local quality awards and their similarities to or differences from the MBNQA criteria.
- Facilitate information sharing among all sectors of the U.S. economy through partnerships with key educational and health care organizations in addition to the current partnerships with business organizations.

Performance Measures
(Total Program)

As described in the NIST Executive Summary, the Baldrige National Quality Program evaluates its performance through a combination of methods including: 1) independent expert review of all aspects of the BNQP's plans and operations by its Board of Overseers, combined with other annual reviews provided by the Panel of Judges and the Foundation for the Baldrige National Quality Award; 2) output tabulations, such as the number of state and local quality award programs supported; and 3) periodic surveys and other assessments of the program's relevance to corporate performance. This year, the BNQP also will conduct a formal economic impact assessment.

Values for key output measures are provided below:

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
• Number of total applications to MBNQA per year ¹	52	54	56	58	60	62	64
• Number of applications to Baldrige-based state and local programs	840	862	879	896	910	923	937
• Number of applications to MBNQA from small businesses	12	13	14	15	16	17	18
• Number of Quality Program documents requested from the World Wide Web	575,000	600,000	625,000	650,000	675,000	700,000	700,000
• Number of printed MBNQA <i>Criteria for Performance Excellence</i> distributed by BNQP	140,600	136,400	133,700	132,300	131,000	129,700	128,400
• Number of printed MBNQA Criteria distributed by Baldrige-based state and local programs	63,000	61,200	60,000	59,400	58,800	58,200	57,600
• Number of state and local quality award programs supported	55	60	61	62	63	64	65

¹ FY 99 and outyear estimates reflect introduction of award programs for health care and education; in prior-years BNQP reported only business applications.

To illustrate the economic significance of the Baldrige criteria, the Baldrige National Quality Program compares the hypothetical value of equivalent financial investments in publicly-traded BNQA recipients and the Standard & Poor's 500 index. This year, the hypothetical "Baldrige Index" - a group of 23 companies that received the MBNQA between 1988 and 1997 - outperformed the S&P 500 by approximately 2.5 to 1. The relevance of the Baldrige criteria to corporate performance was further illustrated by a survey of CEOs conducted in 1998 by Louis Harris & Associates. The survey, which was commissioned by the private-sector Foundation for the Baldrige National Quality Award, found that 79 percent of the 308 respondents believe the Baldrige criteria and awards are "extremely or very valuable" in stimulating improvements in quality in U.S. companies, while 67 percent believe that the Baldrige efforts improve the competitiveness of U.S. business.

In addition to the Harris survey and the annual "Baldrige Index" comparison, the BNQP has initiated a formal economic impact study. The study, which should be completed in 2000, will analyze how the MBNQA criteria have affected U.S. companies' performance management, competitiveness, and quality improvement strategies. Information collected will include impact data on both strategic investment decision-making and ultimate economic impacts. Data collection will focus on the manufacturing sector or a major subset, such as chemicals.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
National Quality Program
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Other	<u>\$50</u>	<u>\$0</u>	<u>\$0</u>
Total, Other Agency	50	0	0
Technical & Advisory Services	2,319	1,600	1,600
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>0</u>
Total, Other Reimbursables	2,319	1,600	1,600
Grand Total, Reimbursable Program	2,369	1,600	1,600

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Research support activities

<u>Line Item</u>		1999		2000		2001		2001		Increase/ (Decrease) Over 2001 Base	
		Actual		Currently Available		Base		Estimate			
		Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount
Technical competence program	Pos./Approp	69	\$9,518	68	\$9,461	68	\$9,785	68	\$9,785	0	0
	FTE/Obl.	69	9,347	69	9,541	69	9,803	69	9,803	0	0
Postdoctoral fellowship program	Pos./Approp	118	7,345	117	7,875	117	8,442	139	11,442	22	\$3,000
	FTE/Obl.	119	8,676	120	9,273	120	8,468	131	9,818	11	1,350
Computer support	Pos./Approp	68	12,262	67	12,179	67	12,500	67	12,500	0	0
	FTE/Obl.	68	12,812	68	12,342	68	12,583	68	12,583	0	0
Financial management systems development	Pos./Approp	0	846	0	2,407	0	7,595	0	7,595	0	0
	FTE/Obl.	0	846	0	2,407	0	7,595	0	7,595	0	0
Minority-serving institutions	Pos./Approp	0	0	0	0	0	0	2	8,000	2	8,000
	FTE/Obl.	0	0	0	0	0	0	2	7,800	2	7,800
Total	Pos./Approp	255	29,971	252	31,922	252	38,322	276	49,322	24	11,000
	FTE/Obl.	256	31,681	257	33,563	257	38,449	270	47,599	13	9,150

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Research support activities

Line Item	1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
Postdoctoral fellowship program										
Direct obligations		0		0		0		\$1,650		\$1,650
Reimbursable FTE/Obl	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	0	0	0	0	0	0	0	1,650	0	1,650
Minority-serving institutions										
Direct obligations		0		0		0		200		200
Reimbursable FTE/Obl	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	0	0	0	0	0	0	0	200	0	200
Technical reimbursable services										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>0</u>	<u>\$242</u>	<u>0</u>	<u>\$546</u>	<u>0</u>	<u>\$546</u>	<u>0</u>	<u>546</u>	<u>0</u>	<u>0</u>
Total	0	242	0	546	0	546	0	546	0	0
Non-technical support services										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>55</u>	<u>7,962</u>	<u>56</u>	<u>7,792</u>	<u>56</u>	<u>8,242</u>	<u>56</u>	<u>8,242</u>	<u>0</u>	<u>0</u>
Total	55	7,962	56	7,792	56	8,242	56	8,242	0	0
Total										
Direct obligations		0		0		0		1,850		1,850
Reimbursable FTE/Obl	<u>55</u>	<u>27,049</u>	<u>56</u>	<u>8,338</u>	<u>56</u>	<u>8,788</u>	<u>56</u>	<u>8,788</u>	<u>0</u>	<u>0</u>
Total	55	27,049	56	8,338	56	8,788	56	10,638	0	1,850

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
RESEARCH SUPPORT ACTIVITIES

Goal Statement

This subactivity facilitates industry and government efforts to enhance the competitiveness of American industry by providing appropriate support for industry's development of broad-based, high-risk technologies, which promise substantial commercial application and by diffusing these advances to users in all segments of the American economy. In particular, this subactivity provides for (1) programs to respond to needs for new technical competencies, (2) regular infusion of outstanding postdoctoral scientists and engineers, (3) maintenance of adequate central scientific computing resources, and (4) development of financial management systems. This program also supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

The programs under this subactivity are centrally managed activities which provide support to other NIST programs. Specifically, the programs provide competence development in NIST mission-oriented areas of research, high caliber scientists and engineers for ongoing research programs, central computing support for the research programs, and NIST financial management systems.

Technical Competence Program - Resources provided through this program enable NIST to respond to new scientific and technical opportunities and to new requirements assigned by the Administration and Congress or imposed by developments in industry, government, academia, or the public. The capacity to respond is based on the availability of teams of scientists and engineers, working at the forefront of research in various areas related to future advanced technologies, who have the ability to devote their efforts to specific, new problems as they arise.

The FY 2001 base program operating objectives include the following:

- Select and initiate up to six new competence projects, at the discretion of the Director and senior NIST managers. This fundamental research will create a window on emerging areas of science and technology and provide NIST scientists and engineers with the knowledge and skills that are necessary to address state-of-the-art measurements and standards opportunities and needs. Selected projects continue to be supported by competence funds for approximately five years.

Postdoctoral Fellowship Program - Through this program, NIST supports a nationally competitive postdoctoral research fellowship program which is administered in cooperation with the National Academy of Sciences/National Research Council. The fellowship program recruits outstanding research scientists and engineers to work on NIST research projects, strengthens communication with university researchers, and provides a valuable mechanism for the transfer of research results from NIST to the scientific and engineering communities.

The FY 2001 base program operating objectives include the following:

- Select postdoctoral scientists and engineers of exceptional promise and ability to perform advanced research related to the NIST mission.
- Introduce the latest university research results and techniques to NIST scientific programs and share NIST's unique research facilities with the U.S. scientific and engineering community.

Computer Support - This program provides staffing, operation, and support of large memory capacity high performance computers, mass disk storage systems, high speed communication networks, scientific visualization facilities and associated systems which comprise the central component of the NIST Scientific Computer Facility (SCF). Services to NIST include: access to central software maintenance and support for scalable high performance parallel distributed memory computer systems, clusters of symmetric memory processors and clusters of heterogeneous computers; assistance, training, and expertise on scientific software packages used on these systems, including mathematical and statistical subroutine libraries, advanced parallel programming, and software for generating graphical output and dynamic visualization of complex results; and distributed user access to a broad range of software for scientific workstations.

The SCF supports essential large-scale high-precision numerical computation, complex dynamic mathematical modeling, sophisticated data analysis, and scientific database management throughout the NIST scientific and engineering community. The SCF enables computational experiments and analyses to complement and support NIST laboratory experimentation and scientific analyses. It fosters new and innovative solutions to priority problems across a wide range of NIST scientific activities, including derivation and prediction

of atomic and molecular properties, automated manufacturing, chemical and material processing, biochemical engineering, and high-performance electronic components. Computer scientists, applied mathematicians, and statisticians provide expert assistance to help SCF users exploit the full capabilities of the SCF resources.

The FY 2001 base program operating objectives include the following:

- Operate high-performance computing systems and associated communications, mass storage, networking, and visualization capabilities to support all NIST scientific and engineering programs.
- Broaden NIST user support to include expanded services from the centralized facility, including file migration, backup and archival storage, improved access to firewall protection, improved usability of parallel computing systems, and application software access and support.

Financial Management Systems Development - This program provides the necessary resources to implement a financial management system at NIST that satisfies the financial management requirements established for the Commerce Administrative Management System (CAMS).

Sound financial management must permeate all DoC programs and operations. The Department's programs and operations must be run by responsible and accountable financial managers who understand all applicable financial management requirements and have ready access to all the data and information needed to satisfy these requirements. In addition, the programs and operations must be supported by modern financial systems, and related concepts of operation, which ensures the integrity, timeliness, and completeness of the data and information.

To implement Commerce's vision for financial and administrative management, the Department is undertaking a major modernization of its various financial and administrative systems, functions, and processes. Commerce envisions a common, user-friendly, and flexible CAMS. The system will be paperless, except as required by law; it will encompass all stages of financial and administrative management processes -- from commitment, to obligation, to cost accrual, to disbursement; it will electronically integrate the related activities of program managers and financial, budget, acquisition, and other administrative professionals; it will make all the administrative management processes inter-operable; and, it will interface with other government administrative systems. The NIST financial management system will be an integral part of the vision for CAMS formulated by the Department.

As presently envisioned, the NIST system will consist of a Core Financial System (CFS) and as many as ten functional and administrative systems. The Core Financial System will provide financial management and accounting services, consisting of six integrated modules:

General Ledger; Financial Reporting; Accounts Payable; Accounts Receivable; Cost Accounting; and Budget Execution. The functional systems all relate to the core but are generally independent of one another.

The FY 2001 base program operating objectives including the following:

- Complete implementation plan to initiate first phase of NIST financial system consistent with business case option selected and funds available.
- Complete update of NIST proforma tests.
- Update NIST interfaces and conversion programs to Core CAMS.
- Complete interface and conversion programs tests.
- Complete training of users parallel test.

Minority-Serving Institutions - There is no base funding in this subactivity directly related to the requested initiative for MSIs, however, a small amount of STRS base funding throughout the Measurement and Standards Laboratories has been directed to MSIs.

Performance Measures
(All Sources of Funding)

The centrally managed activities included in this subactivity provide support throughout NIST's STRS programs. Performance evaluation information for the STRS programs is presented in the General Statement of this budget request. Performance evaluation information specific to each laboratory also appears in each laboratory's base narrative.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

	2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
	Personnel	Amount	Personnel	Amount	Personnel	Amount
Postdoctoral fellowship program Pos./Approp	117	\$8,442	139	\$11,442	22	\$3,000
FTE/Obl.	120	8,468	131	9,818	11	1,350

Postdoctoral fellowship program (+22 Permanent Positions, +11 FTE, BA +\$3,000,000, Direct Obligations +\$1,350,000, Transfer to WCF +\$1,650,000) - To expand the NIST/National Research Council Postdoctoral Fellowship Program and enhance the transfer of advanced technology between universities and NIST, expand the pool of highly skilled scientists and engineers for future NIST staff positions, and provide staff to more flexibly carry out NIST measurements and standards research in response to changing industry needs. An expanded postdoctoral fellowship program will help NIST in supporting the major DoC strategic goals to promote economic growth, stimulate innovation for competitiveness, and advance sustainable economic development. This program also supports the DoC Secretarial priority on Expanding Commerce's Partnerships with Minority Serving Institutions.

The initiative will permit NIST to sponsor a total of approximately 112 postdoctoral fellows (an increase of approximately 22 over the current total of 90). The initiative also includes a modest salary increase for all the fellows to attract and retain the highest quality scientists and engineers in the face of strong hiring competition from industry. The postdoctoral term for each fellow normally last two years, and about one-third of the fellows have converted to permanent NIST staff members in recent years. NIST will work closely with minority-serving institutions to increase the number of minority applicants to the program.

Problem Magnitude and NIST Role:

Skilled engineers and scientists are in short supply nationwide in many fields critical for NIST and industry, including information technology, electronics, and materials science. NIST competes with the private sector to attract and retain the most talented scientists

and engineers and usually cannot match industry salaries inflated by labor shortages. The NIST/NRC Postdoctoral Research Fellowship Program is highly effective at encouraging top quality scientists and engineers to consider a NIST career by providing an exciting and rewarding research environment that more than compensates for the lower government salaries for highly motivated researchers. The two-year postdoctoral period permits the fellows and NIST to assess each other without a long-term commitment.

The NIST/NRC postdoctoral program provides two-year fellowship appointments for outstanding young scientists and engineers chosen through a national competition administered by the National Research Council of the National Academy of Sciences. The appointments allow the Nation's best young scientists, mathematicians, and engineers to participate in state-of-the-art, mission-oriented research in association with senior NIST technical staff and using the advanced research facilities at NIST. The NRC postdoctoral fellows, skilled in the latest university research, bring to NIST new ideas and skills developed at U.S. universities, and help NIST respond more quickly and effectively to new industry measurement and technology needs. Recognizing the benefits of this synergism, Congress authorized an increase to the program level in the National Technology Transfer and Advancement Act of 1995 (P.L. 104-113, signed into law on March 7, 1996). The law amended the NIST Organic Act (15 U.S.C. 278g-2) to allow NIST to hire 60 new fellows per year, for a total of 120 participants.

NIST's mission to support U.S. industry with measurements, standards, and technology depends on a constant infusion of new ideas and expertise to address the rapidly advancing needs of a technology-driven economy. Skilled and motivated people are the most effective source of technology and knowledge transfer. The highly competitive NIST/NRC program ensures a continuing infusion of postdoctoral fellows who bring firsthand to NIST the benefits of the latest academic research. The additional training and experience the fellows receive at NIST is also transferred to industry by fellows leaving NIST, thus helping NIST fulfill its mission to support industry.

Expansion of the NIST/NRC Postdoctoral Fellowship Program would also provide more opportunities to increase the diversity of the NIST scientific and technical staff. Industry and universities compete intensely to hire top young scientists from the unfortunately small pool of about 500 new minority PhD recipients in technical fields each year. A larger NIST/NRC postdoctoral program, coupled with increased NIST efforts to encourage and mentor minority applicants, would help increase the number of minority technical hires at NIST.

Proposed NIST Technical Program:

In recent years, NIST has been maintaining the postdoctoral program at approximately 90 postdoctoral fellows. The requested increase of 22 positions and \$3,000,000 will have a substantially positive impact on the program and NIST as a whole by bringing the program closer to its authorized level of 120 fellows. The initiative will also permit an increase in the salary of all of the fellows from the

current starting level of \$48,500 per year to a more competitive \$51,500 per year. Salaries of the new postdoctoral positions are lapsed at 50 percent because the selection process is generally completed by March of each year. Awardees are offered two-year term appointments, with the costs of relocation and transportation to the duty station paid within the allowances prescribed by law.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Postdoctoral Fellowship Program Initiative	
Technical Area	Outputs
NIST/NRC postdoctoral associateship program	<ul style="list-style-type: none">• Twenty-two additional new postdoctoral fellows hired annually.• Twenty-two technical papers published annually by the additional postdoctoral associates.• Conversion of seven additional postdoctoral fellows annually to permanent NIST staff.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- Increased technology transfer to NIST from universities;
- Increased technology transfer from NIST to industry, academia, and other government agencies;
- Expansion of the pool of the most highly qualified technical scientists and engineers for permanent NIST staff positions; and
- Enhanced flexibility of NIST to respond to rapidly changing industry needs.

The NIST/NRC postdoctoral program is an important part of NIST's efforts to support industry through advancing measurements, standards, and technology and represents a highly cost-effective means of technology transfer to and from NIST of the latest measurement science and technology. Incoming fellows bring to NIST the most recent advances in university research while actively contributing to NIST projects such as:

- development of laser cooling and trapping of atoms and ions for ultraprecise new time and frequency standards that support the Global Positioning System, among many other applications;
- development of new ways to measure microscopic properties of magnetic materials to support much greater density magnetic

- storage media;
- demonstration of new techniques to measure materials properties on an atom-by-atom basis to support development of new generations of microelectronic devices; and
- development of new spectroscopic techniques to measure minute quantities of chemicals to ensure ultrahigh purity of gases used in semiconductor processing and to detect trace amounts of deadly nerve gases for civilian and military defense applications.

Expansion of the postdoctoral program is expected to accelerate measurements and standards R&D at NIST.

Outgoing postdoctoral fellows take with them a wealth of expertise and knowledge about NIST science and technology to their new positions, usually in industry, academia, or other government laboratories, disseminating the unique perspective of NIST to broader areas of the economy. Expansion of the program will increase the breadth of technology transfer to and from NIST.

The program is a highly cost-effective recruitment tool for NIST. The NIST/NRC program is widely known and respected throughout U.S. universities and effectively advertises NIST opportunities. The comprehensive evaluation of prospective research associates is conducted by technical experts from across the Nation under NRC administration, ensuring selection of the best quality candidates at a minimal cost to NIST. In recent years, about one third of the NRC fellows have accepted permanent positions at NIST following their postdoctoral tenure, accounting for a significant fraction of NIST technical hires. Expansion of the postdoctoral program is likely to increase the number of conversions of highly skilled postdoctoral associates to permanent NIST staff.

Expansion of the postdoctoral program will give NIST greater flexibility to rapidly respond to new industry measurement needs. Each year, a large number of new graduates from a wide variety of technical backgrounds apply for the NIST/NRC research associateships. Sponsoring a postdoctoral associate can be a highly effective means to broaden NIST skills into new areas through the expertise and new ideas brought to NIST by the fellow. The naturally limited term of the associates eases the burden of sequential hiring and dismissing of staff with specific expertise as program focus changes.

In addition, an expanded program will provide NIST with more opportunities to compete with industry and academia to hire top young minority scientists and engineers. NIST will increase its efforts to encourage minority PhD candidates to apply for the prestigious NIST/NRC postdoctoral fellowships, will build stronger relationships with minority serving institutions to increase the number of minority postdoctoral applicants, and will provide stronger mentoring of minority candidates to help them through the application process (consistent with NRC regulations governing the process).

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Research support activities

Program Change: Postdoctoral fellowship program

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Postdoctoral Fellow	ZP III	22	51,500	1,133,000
Subtotal		<u>22</u>		<u>1,133,000</u>
Less lapse	50 %	(11)		(566,500)
Total full-time permanent (FTE)		<u>11</u>		<u>566,500</u>
2001 Pay Adjustment (3.7%)				20,961
Total				<u>587,461</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		11		
Authorized Positions:				
Full-time permanent		22		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Research support activities

Program Change: Postdoctoral fellowship program

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$587
11.9 Total personnel compensation	587
12.1 Civilian personnel benefits	144
21 Travel and transportation of persons	69
22 Transportation of things	57
23.3 Communications, utilities and miscellaneous charges	150
24 Printing and reproduction	15
25.1 Advisory and assistance services	0
25.2 Other services	100
25.3 Purchases of goods and services from Government accounts	81
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	32
26 Supplies and materials	103
31 Equipment	12
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 1,350
Transfer to NIST Working Capital Fund	1,650
Total increase requested	<hr/> 3,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

		2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
		<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Minority-serving institutions.....	Pos./Approp	0	0	2	\$8,000	2	\$8,000
	FTE/Obl.	0	0	2	7,800	2	7,800

Minority-serving institutions (+2 Permanent Positions, +2 FTE, BA +\$8,000,000, Direct Obligations +\$7,800,000, Transfer to WCF +\$200,000) – To enhance the U.S. economy and promote full economic participation by all citizens by more effectively using scientific and technical resources in the Nation’s minority-serving institutions (MSIs). MSIs represent an underutilized resource with respect to contributions to the U.S. technical and economic base. Furthermore, the historical under-representation of minorities trained in high technology disciplines provides an opportunity to improve the technical expertise of a substantial student pool, thereby increasing the quality of U.S. science and technology. MSIs include Historically Black Colleges and Universities (located in 20 states, the District of Columbia, and the Virgin Islands), Hispanic-Serving Institutions (9 states and Puerto Rico), and Tribal Colleges and Universities (12 states). This initiative is part of a DoC effort to develop a high-impact, high-visibility program to increase participation in sciences and provide increased contributions of MSIs to the U.S. economic and technology base. The initiative contributes integral parts to the establishment of Department-wide Commerce Student Fellowship and Commerce Centers of Excellence Initiatives for FY 2001, and partnering with MSIs to improve delivery of NIST services. This work supports the DoC strategic goals to promote economic growth, stimulate innovation for competitiveness, and advance sustainable economic development. This work also supports the DoC Secretarial priority on Expanding Commerce’s Partnerships with Minority-Serving Institutions.

Problem Magnitude and NIST Role:

Minorities are frequently underrepresented in technology fields. By the year 2050, close to half the U.S. population is projected to be composed of minorities. This is a tremendous untapped labor base. There are additional business reasons to improve the diversity of

our scientific and engineering base. Management and leadership teams which lack diversity have a difficult time comprehending and responding to the issues that organizations must deal with in a multi-cultural world. Diversity is critical to organizational leadership, strategic responsiveness and management effectiveness. Effective working relationships with suppliers are increasingly being identified as critical success factors for businesses as they seek to maximize the effectiveness and efficiency of all linkages in the value-chain. As business is done more and more through partnerships, joint ventures and strategic alliances, an ability to relate to other cultures becomes a key organizational requirement. Organizations seeking to become global players will be much more competitive with high levels of diversity in their workforces. An ethnically diverse workforce can make a company more profitable (Dimensions of Diversity in Canadian Business: Building a Business Case for Valuing Ethnocultural Diversity; 1995, The Conference Board of Canada). One key to gaining a global advantage is gathering an "international" employee base to serve as a natural bridge and help firms penetrate those emerging markets.

Technology is probably the single most important factor in supporting sustained economic growth and improvement in the quality of life for the Nation and the world. One of the widely recognized strengths of the U.S. innovation system is the degree to which our universities work collaboratively with industry to develop new technologies and move them toward commercial applications. Although university-industry technical collaboration is widespread, it is not as common a practice in some areas of the economy, particularly among MSIs.

In order to provide the technical support needed by most areas of modern commerce, a supply of technical expertise is critical. New approaches and technologies and well-trained people are vital components necessary for development of high tech industries and applying modern technology to make other industries more efficient. New technologies and practices are being introduced to the marketplace at a staggering pace, leading to an ever-increasing need for science and technology resources. Efficient development of additional sources of expertise and technical development within the U.S. could have an extremely beneficial incremental effect on our economy. This additional source appears available through the development and more efficient utilization of MSI capabilities, which have been underutilized to date.

NIST has the expertise and ability to use outreach programs to substantially improve the U.S. pool of technical experts. Two primary reasons for NIST sponsorship of the MSI initiative are the TA mandate to enhance technology transfer and the NIST role as a premier government laboratory. The technical program addresses the supply of technically trained experts available in the U.S. In addition, the program will improve the usefulness of technical output and effectiveness of technology transfer from MSIs, a substantial fraction of which have historically poor technology transfer results. These poor results are generally attributable to lack of resources and know-how to establish technology transfer offices within the institutions. The program detailed below will improve the relevance and quality of technical research and the technology transfer capabilities within MSIs. The technical expertise available at NIST is essential to ensure that the various parts of the proposed program are focused and target the stated goals.

NIST and the economy will benefit from greater use of expertise already present in many MSIs. Many MSIs already have excellent capabilities in areas that can promote NIST's mission of enhancing economic growth by supporting U.S. industry. For example, NIST conducts training classes in measurement technology on-site at NIST facilities. Scientists and technicians from industry, government, and universities attend these classes to learn the latest and best measurement techniques to improve manufacturing productivity and research and development. However, only a few dozen students can be accommodated each year because of constraints of space, class instructors, and available funds. NIST could partner with MSIs with expertise in electronic communications (Internet, interactive computer programs on compact discs, etc.) to greatly extend the reach of the NIST training classes, benefiting industry, NIST, and the participating MSIs.

Proposed NIST Technical Program:

Department of Commerce Centers of Excellence: A number of MSI technical departments are not in the top tier of research universities. A top tier status is often determined by the presence of four components: excellent professors; publications; graduate students; and facilities and equipment. The last three of these can be improved dramatically by developing collaborative efforts among NIST research laboratories, MSI departments and top tier research institutions in the country. This program will make grants and cooperative agreements available to MSI departments, part of which will be transferred to corresponding departments at top tier research universities to facilitate these collaborative efforts.

This program will be initiated through visits by senior-level NIST scientists to various MSIs to identify areas of mutual interest where a research-oriented MSI graduate program exists in an area of prime interest to NIST. Top tier research universities would then be identified which could be paired with the MSI. These collaborations, preferably involving universities which are geographically close to each other, will provide opportunities for faculty and students at the MSI to use excellent facilities, develop ideas with other faculty and students, and write technical papers and patents jointly. There are several benefits of NIST involvement: NIST and the participating institutions benefit from cross-fertilization of ideas, a more complete array of laboratory equipment and facilities would be available within the three-way research group, and NIST experience in working with industry would provide guidance toward targets with practical commercial applications.

Another key part of the program is the broadening of the experience of faculty from various MSI departments who are brought to NIST to work for sabbaticals under Intergovernmental Personnel Act agreements. Faculty from research departments would benefit from exposure to the world-class facilities of NIST and learn practical aspects of designing and conducting R&D while contributing to the output of the NIST laboratories. In particular, various NIST approaches toward work with industry would provide experience which could benefit the entire department when the faculty member returns to the MSI.

This program has strong potential to build first-rate capacity at several MSIs. The four key components of a first-tier research department will be developed, including substantial improvements in faculty experiences, publications (co-authored with NIST or non-MSI university staff), graduate students with broader experiences, and access to world-class facilities and equipment. After some period of development of faculty experiences, the level of the MSI department should rise significantly, allowing the hiring of first-tier level professors. The development of such capabilities then provides a substantial increase to the U.S. science and technology base, building on a resource which is readily available.

Commerce Student Fellowship Program: NIST has long been committed to increasing the number of minorities in its high technology fields. In this program, NIST will provide financial assistance to support students and postdoctoral fellows at MSIs. The target MSIs will be determined by the particular degree level being sought by the student. Graduate student fellowships and postdoctoral fellowships will be given through the MSIs which have strong departments in technical areas critical to NIST. Through this program, graduate students or NIST staff with strong potential for graduate work would be funded to complete course work for a Master of Science or Doctor of Philosophy degree, with dissertation research to be conducted partially or totally within a NIST laboratory. This approach provides close ties between the activities of the MSI and the NIST laboratories, cross-fertilizing ideas of MSI faculty and students with the NIST personnel experienced in high technology areas directly relevant to industry. In addition, the students would benefit from access to excellent research facilities at NIST.

Fellowships for undergraduate students will target a wider range of the MSIs, since many MSIs which do not have graduate departments have strong undergraduate programs. Junior and Senior level students will be offered financial assistance to pursue majors in fields of interest to NIST programs. As part of the training for students under this program, undergraduates will work on collaborative programs in the NIST laboratories during summer or other breaks. In this manner, the students will be exposed to the world-class facilities of NIST and learn practical aspects of designing and conducting research and development while contributing to the output of the NIST laboratories.

Collaborative Metrology Training: An area of great mutual opportunity for MSIs and for NIST is collaboration to help train scientists and technicians in industry, government, and universities in the best measurement technology. Metrology - the science and art of measurements - is key to ensuring quality and improving productivity in manufacturing and to supporting research and development at all levels - from developing new products in industrial labs to fundamental research at universities. NIST will work with MSIs to develop new electronic training methods for metrology using NIST expertise to provide training content and MSI expertise to develop and disseminate electronic courses that reach target audiences nationwide through such media as interactive Internet, interactive desktop presentations, and other new communications methods.

NIST conducts on-site training in metrology for various applications: high accuracy length measurements; temperature measurements using all different types of technology; accurate measurement of time and frequency; and many others. These courses are in great demand by scientists, engineers, and technicians from industry, universities, and government labs, but only a few dozen students can be accommodated each year because of limitations in classroom space, availability of instructors, and budget considerations. It is also expensive for students to attend the courses, which usually last several days, because of travel expenses and lost time from work. The high cost of human and physical resources needed for the courses also discourages the development of new training materials.

The impact of the NIST metrology training courses could be enormously expanded through MSI/NIST collaboration to use the Internet, advanced video-conferencing, interactive desktop computer programs, and other advanced communications methods to reach greatly expanded audiences. NIST world-leading experts in metrology would provide the course content. MSIs would provide the technical expertise in developing electronic courses and disseminating them through various media. Grants through the MSI initiative would support both course development at MSIs and be used to build additional information technology infrastructure at MSIs to help in course development and dissemination.

Without the constraints of “brick and mortar” classrooms, NIST experts will reach target scientists, engineers, and technicians across the Nation. NIST experts will be motivated to develop new training materials - expanding into new metrology areas - since they will not be constrained by the high costs and time commitment of “face to face” teaching. Far more students will take NIST courses since they will not be constrained by travel expenses, inconvenient times, lost work time, and highly limited openings in the traditional classrooms.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Minority Serving Institutions Initiative	
Technical Area	Outputs
Department of Commerce Centers of Excellence	<ul style="list-style-type: none">• Establish two consortia containing one major research university and at least two MSI.• Publish two technical publications (Year Two).• Fund completion of two M.S. degrees (Year Two), three M.S. degrees (Year Three), one Ph.D. degree (Year Four) involved in the MSI program.• Bring 10 MSI faculty members to NIST for one year sabbaticals under IPAs.
DoC Student Fellowship Program	<ul style="list-style-type: none">• Enroll two undergraduate students (Year One) and an additional five students in Year Two.• Enroll two graduate students (Year One), ramping to a total of 10 in Year Five.• Award two two-year Postdoctoral Fellowships per year.• Publish four publications in Year Two, increasing to 10 per year by Year Five.
Collaborative Metrology Training	<ul style="list-style-type: none">• Establish metrology training electronic course development center in at least one MSI.• Develop two new NIST metrology training courses.

Performance Measures: Outcomes

This initiative will add to the technical expertise that the Nation's high technology industries need to continue to lead the world in the coming years. Bringing the best and brightest minds at the MSIs into a contributing role in the U.S. research and development effort is expected to have a measurable impact on the rate of high technology development. This in turn will lead to a measurable impact on U.S. economic growth since about half of our economic growth is attributable to technology development. A fraction of a percent improvement in economic growth due to the addition of this technical expertise will result in a significant increase in the standard of living in the U.S.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards

Subactivity: Research support activities

Program Change: Minority-serving institutions

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
General business specialist	ZA IV	2	71,861	143,722
Subtotal		<u>2</u>		<u>143,722</u>
Less lapse	25 %	0		(35,930)
Total full-time permanent (FTE)		<u>2</u>		<u>107,792</u>
2001 Pay Adjustment (3.7%)				3,988
Total				<u>111,780</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		2		
Authorized Positions:				
Full-time permanent		2		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Measurement and engineering research and standards

Subactivity: Research support activities

Program Change: Minority-serving institutions

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$112
11.9 Total personnel compensation	112
12.1 Civilian personnel benefits	28
21 Travel and transportation of persons	183
22 Transportation of things	24
23.3 Communications, utilities and miscellaneous charges	36
24 Printing and reproduction	15
25.1 Advisory and assistance services	0
25.2 Other services	14
25.3 Purchases of goods and services from Government accounts	14
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	6
26 Supplies and materials	38
31 Equipment	17
32 Land and structures	0
41 Grants, subsidies and contributions	7,313
99 Direct obligations	<hr/> 7,800
Transfer to NIST Working Capital Fund	200
Total increase requested	<hr/> 8,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Research Support Activities
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Department of Commerce	\$6,066	\$6,027	\$6,627
Dept. of Housing & Urban Development	38	38	0
General Services Administration	148	148	0
Other	<u>210</u>	<u>511</u>	<u>511</u>
Total, Other Agency	6,462	6,724	7,138
Technical & Advisory Services	1,742	1,614	1,650
WCF Investments/Operating Adjustments	<u>18,845</u>	<u>0</u>	<u>1,850</u>
Total, Other Reimbursables	20,587	1,614	3,500
Grand Total, Reimbursable Program	27,049	8,338	10,638

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>1999 Actual</u>	<u>2000 Currently Available</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
11 Personnel compensation					
11.1 Full-time permanent	\$122,066	\$126,014	\$132,582	\$137,019	\$4,437
11.3 Other than full-time permanent	10,727	11,149	11,541	11,541	0
11.5 Other personnel compensation	4,266	4,266	4,266	4,266	0
11.9 Total personnel compensation	137,059	141,429	148,389	152,826	4,437
12.1 Civilian personnel benefits	29,336	31,054	33,145	34,232	1,087
13 Benefits for former personnel	164	164	164	164	0
21 Travel and transportation of persons	6,182	6,214	6,450	7,337	887
22 Transportation of things	936	935	947	1,220	273
23.1 Rental payments to GSA	60	62	63	63	0
23.2 Rental payments to others	2,739	2,765	2,805	2,805	0
23.3 Communications, utilities, and miscellaneous charges	11,348	11,543	11,690	12,812	1,122
24 Printing and reproduction	587	644	670	870	200
25.1 Advisory and assistance services	3,554	3,517	3,816	3,816	0
25.2 Other services	22,538	21,060	20,958	29,277	8,319
25.3 Purchases of goods and services from Government accounts	9,375	11,985	12,258	13,522	1,264
25.5 Research and development contracts	1,390	1,897	1,949	8,811	6,862
25.7 Operation and maintenance of equipment	3,370	3,333	3,426	3,910	484
26 Supplies and materials	14,954	17,226	16,058	17,444	1,386
31 Equipment	23,025	23,026	23,358	24,024	666
32 Land and structures	843	843	843	843	0
41 Grants, subsidies, and contributions	11,822	12,379	12,379	18,332	5,953
42 Insurance claims and indemnities	12	0	0	0	0
99 Total Obligations	279,294	290,076	299,368	332,308	32,940

<u>Object Class</u>		1999 Actual	2000 Currently Available	2001 Base	2001 Estimate	Increase/ (Decrease) over 2001 Base
99	Total Obligations	279,294	290,076	299,368	332,308	32,940
	Less Prior Year Recoveries	(835)	(1,000)	(1,000)	(1,000)	0
	Less Prior Year Unobligated Balance	(6,063)	(6,938)			
	Plus Unobligated Balance, End of Year	6,938				
	Total Budget Authority	279,334	282,138	298,368	331,308	32,940
	Transfer to NIST Working Capital Fund	398	0	0	6,200	6,200
	Total Requirements	279,732	282,138	298,368	337,508	39,140

Personnel Data

Full-time equivalent employment:

Full-time permanent	1,845	1,831	1,833	1,896	63
Other than full-time permanent	217	217	217	217	0
Total	2,062	2,048	2,050	2,113	63

Authorized Positions:

Full-time permanent	1,980	1,920	1,922	2,013	91
Other than full-time permanent	67	67	67	67	0
Total	2,047	1,987	1,989	2,080	91

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
11 Personnel compensation				
11.1 Full-time permanent				
Executive level	\$4	\$135	\$135	0
Senior executive service	277	4,887	4,887	0
Career path	5,896	117,943	122,380	\$4,437
Wage board	240	6,953	6,953	0
Scientific & professional (P.L. 80-313)	<u>91</u>	<u>2,664</u>	<u>2,664</u>	<u>0</u>
Subtotal	6,508	132,582	137,019	4,437
11.3 Other than full-time permanent				
Career path	360	9,983	9,983	0
Wage board	11	203	203	0
Scientific & professional (P.L. 80-313)	5	129	129	0
Experts & consultants	16	438	438	0
Student	<u>0</u>	<u>788</u>	<u>788</u>	<u>0</u>
Subtotal	392	11,541	11,541	0
11.5 Other personnel compensation				
Overtime	0	1,170	1,170	0
SES performance awards	0	106	106	0
Cash awards	0	2,864	2,864	0
Other	<u>0</u>	<u>126</u>	<u>126</u>	<u>0</u>
Subtotal	0	4,266	4,266	0
11.9 Total personnel compensation	<u>6,900</u>	<u>148,389</u>	<u>152,826</u>	<u>4,437</u>

<u>Object Class</u>	<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
12.1 Civilian personnel benefits				
Civil service retirement	(313)	4,124	4,124	0
Federal employees' retirement	935	9,899	10,382	483
Contribution to civil service retirement & disability	0	0	0	0
Thrift savings plan	169	3,592	3,680	88
Federal Insurance Contribution Act	651	7,881	8,220	339
Health insurance	677	6,556	6,728	172
Life insurance	12	235	240	5
Employees' Compensation Fund	(54)	491	491	0
Other	<u>0</u>	<u>367</u>	<u>367</u>	<u>0</u>
Subtotal	2,077	33,145	34,232	1,087
13 Benefits for former personnel				
Severance pay	0	121	121	0
Unemployment compensation	<u>0</u>	<u>43</u>	<u>43</u>	<u>0</u>
Subtotal	0	164	164	0
21 Travel and transportation of persons				
Common carrier	105	2,136	2,425	289
Mileage	0	135	154	19
Per diem/actual	131	3,010	3,439	429
Other	<u>0</u>	<u>1,169</u>	<u>1,319</u>	<u>150</u>
Subtotal	236	6,450	7,337	887
22 Transportation of things	12	947	1,220	273
23.1 Rental payments to GSA	1	63	63	0
23.2 Rental payments to others	40	2,805	2,805	0

<u>Object Class</u>	<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
23.3 Communications, utilities, and miscellaneous charges				
Rental of ADP equipment	0	909	915	6
Rental of office copying equipment	5	169	195	26
Other equipment rental	10	531	604	73
Federal telecommunications system	0	357	399	42
Other telecommunications services	13	1,199	1,373	174
Postal Service by USPS	0	821	895	74
Utilities:				
Electric	82	5,049	5,519	470
Gas	22	1,527	1,680	153
Water/Sewer	15	1,128	1,232	104
Subtotal	147	11,690	12,812	1,122
24 Printing and reproduction				
Publications	17	430	568	138
Other	9	240	302	62
Subtotal	26	670	870	200
25.1 Advisory and assistance services				
Management & professional support services	17	2,166	2,166	0
Studies, analyses, & evaluation	12	1,380	1,380	0
Engineering & technical services	270	270	270	0
Subtotal	299	3,816	3,816	0
25.2 Other services				
Training	20	1,517	1,878	361
ADP Services	5,242	9,279	9,443	164
[Commerce administrative management system (s]	[5,188]	[6,195]	[6,195]	[. . .]
Other non-government contracts	1,232	10,162	17,956	7,794
Subtotal	6,494	20,958	29,277	8,319
25.3 Purchases of goods and services from Government accounts				
Payments to GA, WCF	(350)	6,987	6,987	0
[Commerce administrative management system (s]	[. . .]	[1,400]	[1,400]	[. . .]
Office of Personnel Management	220	284	284	0
Other Federal agencies:				
Department of Commerce	(722)	320	1,465	1,145
Other	1,125	4,667	4,786	119
Subtotal	273	12,258	13,522	1,264

<u>Object Class</u>	<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
25.5 Research and development contracts	52	1,949	8,811	6,862
25.7 Operation and maintenance of equipment	93	3,426	3,910	484
26 Supplies and materials				
Office & laboratory supplies	170	10,179	11,565	1,386
Scientific publications & journals	0	1,526	1,526	0
Fuel oil	0	48	48	0
Reactor materials	<u>78</u>	<u>4,305</u>	<u>4,305</u>	<u>0</u>
Subtotal	248	16,058	17,444	1,386
31 Equipment				
Office machines and other equipment	70	2,456	2,770	314
ADP equipment	37	4,872	5,224	352
Equipment amortization	<u>225</u>	<u>16,030</u>	<u>16,030</u>	<u>0</u>
Subtotal	332	23,358	24,024	666
32 Land and structures	0	843	843	0
41 Grants, subsidies, and contributions	0	12,379	18,332	5,953
42 Insurance claims and indemnities	0	0	0	0
99 Total Obligations	<u>17,230</u>	<u>299,368</u>	<u>332,308</u>	<u>32,940</u>
Less Prior Year Recoveries	<u>(1,000)</u>	<u>(1,000)</u>	<u>(1,000)</u>	<u>0</u>
Total Budget Authority	16,230	298,368	331,308	32,940
Transfer to NIST Working Capital Fund	<u>0</u>	<u>0</u>	<u>6,200</u>	<u>6,200</u>
Total Requirements	16,230	298,368	337,508	39,140

Department of Commerce
Technology Administration
National Institute of Standards and Technology

Scientific and Technical Research and Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For necessary expenses of the National Institute of Standards and Technology,

15 U.S.C. 272; 272 note; 273; 278b-e; 278g; 278h; 278p
15 U.S.C. 290b-f
15 U.S.C. 1454(d), 1454(e)
15 U.S.C. 1512
15 U.S.C. 3711(a)c
40 U.S.C. 759(f)

15 U.S.C. 272; 273; 278b-e provide basic authority for the performance of the functions and activities of the National Institute of Standards and Technology.

15 U.S.C. 272 note provides for educationally useful Federal equipment to be donated to public or private schools.

15 U.S.C. 278g establishes a teacher science and technology enhancement program for professional development of math and science teachers.

15 U.S.C. 278h authorizes appropriations for performance and functions of the National Institute of Standards and Technology.

U.S.C. 278p requires NIST to notify the Committees on Science and Appropriations of the House of Representatives and the Committees on Commerce, Science and Transportation and Appropriations of the Senate before any major reorganization of any program, project, or activity.

15 U.S.C. 290b-f directs the Secretary of Commerce to provide for the collection, compilation, critical evaluation, publication, and dissemination of standard reference data.

15 U.S.C. 1454(d), 1454(e) assign responsibilities to the Secretary of Commerce to determine when undue proliferation exists, to develop and publish voluntary product standards, and to maintain surveillance of such standards.

15 U.S.C. 1512 provides "It shall be the province and duty of said Department to foster, promote, and develop the foreign and domestic commerce... of the United States."

15 U.S.C. 3711(a)c extends the Malcolm Baldrige Award to Health Care and Education providers.

40 U.S.C. 759(f) authorizes the Secretary of Commerce to undertake research in the science and technologies of automatic data processing, computer and related systems, and to establish uniform Federal standards.

2. \$337,508,000, to remain available until expended,

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states: "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provisions."

3. of which not to exceed \$6,200,000 may be transferred to the "Working Capital Fund."

15 U.S.C. 278b

15 U.S.C. 278b provides in part: "The National Institute of Standards and Technology is authorized to utilize in the performance of its functions the Working Capital Fund..."

Additional authorizing legislation will be proposed for FY 2001.

Department of Commerce
National Institute of Standards and Technology
Scientific and Technical Research and Services
SCHEDULE OF ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY 2001 <u>Estimate</u>
Management and professional support services	\$2,172	\$2,149	\$2,166
Studies, analyses, and evaluations	1,382	1,368	1,380
Engineering	<u>...</u>	<u>...</u>	<u>270</u>
Total	3,554	3,517	3,816

Significant Activities

Advisory and assistance services funded by the STRS appropriation include:

- (1) evaluation of candidates for the NIST Postdoctoral Fellowship program.
- (2) the review and evaluation of the technical functions and operations of NIST by the Board on Assessment of the National Academy of Sciences. The Evaluation Panels consider the importance and relative priority of projects, quality of staff, equipment needs, and finances, and the relation of the program to the mission of NIST.
- (3) services for core support for the operations of the U.S. Committee for the Committee on Data for Science and Technology (CODATA).

Need for Advisory and Assistance Services:

The need for advisory and assistance services stems from the NIST role in dealing with the private sector, professional organizations, and the public sector. Inputs must be obtained from consultants who can bring their individual expertise to bear and help NIST in assessing its program plans to meet the needs of its customers. The alternative to utilizing these services is to make no attempt to have expertise from

sources outside NIST and risk having a poorer working and professional relationship with those in the business of using the products and services offered by NIST.

Internal Controls to Ensure Appropriate Use:

Requisition requests from NIST program managers for advisory and assistance services must be accompanied by written justification for the need for such services. Personal services contracts require review by the Office of Human Resources Management.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

Page No.			<u>Positions</u>	<u>FTE</u>	<u>Budget Authority</u>	<u>Direct Obligations</u>	<u>Appro- priation</u>
	Currently Available, 2000		379	393	\$246,780	\$316,081	\$246,780
	less: Unobligated balance from prior year		0	0	0	(65,501)	0
	less: 2000 Prior year recoveries		0	0	0	(3,800)	0
	plus: Unobligated balance carried forward		0	0	0	19,333	0
NIST- 193	plus: 2001 Adjustments to base		0	0	5,803	5,803	5,803
	less: 2001 Prior year recoveries		0	0	(3,800)	0	(3,800)
	2001 Base Request		379	393	248,783	271,916	248,783
	plus: 2001 Program changes		44	32	89,221	89,221	90,821
	2001 Estimate		423	425	338,004	361,137	339,604

			1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
	<u>Comparison by activity:</u>		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
	Extramural programs											
NIST- 201	Advanced technology program	Pos./Approp	270	\$197,411	270	\$142,600	270	\$143,646	270	\$175,467	0	\$31,821
		FTE/Obl.	271	190,343	280	211,000	280	166,779	280	198,600	0	31,821
NIST- 213	Manufacturing extension partnership	Pos./Approp	107	106,768	109	104,180	109	105,137	111	114,137	2	9,000
		FTE/Obl.	89	127,901	113	105,081	113	105,137	114	114,137	1	9,000
NIST- 229	Institute for information infrastructure protection	Pos./Approp	0	0	0	0	0	0	42	50,000	42	50,000
		FTE/Obl.	0	0	0	0	0	0	31	48,400	31	48,400
	TOTALS	Pos./Approp	377	304,179	379	246,780	379	248,783	423	339,604	44	90,821
		FTE/Obl.	360	318,244	393	316,081	393	271,916	425	361,137	32	89,221

	1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
<u>Comparison by activity:</u>										
Adjustments to obligations:										
Prior year recoveries		(28,291)		(20,000)		(3,800)		(3,800)		0
Unobligated balance, start of year		(33,408)		(68,634)		(19,333)		(19,333)		0
Unobligated balance, end of year		68,634		19,333						
Financing from transfers:										
Transfers to other accounts (+)								1,600		1,600
Transfers from other accounts (-)		<u>(21,000)</u>								
Appropriation		304,179		246,780		248,783		339,604		90,821

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	<u>Perm Pos</u>	<u>FTE</u>	<u>Amount</u>
<u>Transfers:</u>			
Transfer to GA for security.....	(136)
<u>Adjustments:</u>			
Restoration of FY 2000 Deobligation offset.....	\$3,800
<u>Financing:</u>			
FY 2001 Deobligation offset.....	(3,800)
<u>Other Changes:</u>			
2000 Pay raise (annualization).....	352
2001 Pay raise.....	862
Within-grade step increases.....	292
One less compensable day.....	(118)
Personal Benefits:			
Civil Service Retirement System (CSRS).....	(89)
Federal Employees' Retirement System (FERS).....	111
Thrift Savings Plan (TSP).....	21
Federal Insurance Contribution Act (FICA).....	71
Health Insurance.....	125
Employees' Compensation Fund.....	(16)
Travel and transportation of persons.....			
Per diem.....	23
Common carrier.....	24
Transportation of things.....	1
Rental payments to others.....	12
Communications, utilities, and miscellaneous charges.....	41
Printing and reproduction.....	6
Other services.....			
Executive development & leadership training (SES 2000).....	35
Working Capital Fund (GA).....	19
Other contracts/services.....	302
Supplies and materials.....	25
Equipment.....	<u>40</u>
Total, Adjustments to Base.....	2,003

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

FTE Amount

Transfer:

Transfer to GA for security	0	(\$136)
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A decrease of \$136,000 reflects a transfer to the General Administration appropriation of security costs previously funded by the GA, WCF.

Adjustments:

Restoration of FY 2000 Deobligation offset	0	3,800
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In FY 2000 NIST's budget authority was reduced by \$3,800,000 based on an estimated level of prior year deobligations. This adjustment would restore the reduction in FY 2001.

Financing:

FY 2001 Deobligation offset	0	(3,800)
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NIST's FY 2001 budget authority is being reduced by the estimated level of prior year deobligations.

Other Changes:

2000 Pay raise (annualization)	0	352
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A pay raise of 4.8 percent was effective January 1, 2000.

Total cost in FY 2001 of 2000 pay raise	\$1,318,000
Less amount requested in FY 2000	(956,000)
Less amount absorbed in FY 2000	<u>(15,000)</u>
Amount requested in 2001 to provide full-year cost of 2000 pay raise	347,000
Payment to Working Capital Fund.....	<u>5,000</u>
Total, FY 2000 pay raise increase in FY 2001	352,000

2001 Pay increase and related costs 0 862

A general pay raise of 3.7 percent is assumed to be effective January 1, 2001.

Total cost in FY 2001 of pay increase.....	\$849,000
Less amount absorbed in FY 2001	<u>0</u>
Amount requested for FY 2001 pay increase	849,000
Payment to Working Capital Fund.....	<u>13,000</u>
Total adjustment for FY 2001 pay increase	862,000

Within-grade step increases 0 292

An increase of \$292,000 is required to cover the cost of within-grade step increases.

One less compensable day..... 0 (118)

The decreased cost of one less compensable day in FY 2001 compared to FY 2000 is calculated by dividing the FY 2000 estimated personnel compensation and applicable benefits by 261 compensable days.

Personnel benefits.....	0	223
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Civil Service Retirement System (CSRS).....	(89)
Federal Employees' Retirement System (FERS).....	111
Thrift Savings Plan (TSP)	21
Federal Insurance Contribution Act (FICA) - OASDI.....	71
Health Insurance.....	125
Employees' Compensation Fund.....	(16)

Civil Service Retirement System (-\$89,000) - The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will drop from 39.2 percent in FY 2000 to 35.1 percent in FY 2001. Contribution rates will remain the same.

Payroll subject to retirement systems (\$25,365,500)	
Cost of CSRS contributions in FY 2001 ($\$25,365,500 \times .351 \times .0851$)	\$757,670
Cost of CSRS contributions in FY 2000 ($\$25,365,500 \times .392 \times .0851$)	<u>846,173</u>
Total adjustment-to-base	(88,503)

Federal Employees' Retirement System (\$111,000) - The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will rise from 60.8 percent in FY 2000 to 64.9 percent in FY 2001. The contribution rate will remain at 10.7 percent in FY 2001.

Payroll subject to retirement systems (\$25,365,500)	
Basic benefit cost in FY 2001 ($\$25,365,500 \times .649 \times .107$)	\$1,761,456
Basic benefit cost in FY 2000 ($\$25,365,500 \times .608 \times .107$)	<u>1,650,178</u>
Total adjustment-to-base	111,278

Thrift Savings Plan (\$21,000) - The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate is expected to remain 2 percent.

Thrift plan cost in FY 2001 ($\$25,365,500 \times .649 \times .02$).....	\$329,244
Thrift plan cost in FY 2000 ($\$25,365,500 \times .608 \times .02$).....	<u>308,444</u>
Total adjustment-to-base	20,800

Federal Insurance Contributions Act (FICA) - OASDI (\$71,000) - As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will rise from \$73,275 in FY 2000 to \$78,450 in FY 2001. The OASDI tax rate will remain 6.2 percent in FY 2001.

FERS payroll subject to FICA tax in 2001 ($\$25,365,500 \times .649 \times .932 \times .062$).....	\$951,252
FERS payroll subject to FICA tax in 2000 ($\$25,365,500 \times .608 \times .925 \times .062$).....	<u>884,465</u>
Increase (FY 2000-FY 2001).....	66,787
OTP payroll subject to FICA tax in FY 2001 ($\$1,423,500 \times .649 \times .932 \times .062$).....	\$53,384
OTP payroll subject to FICA tax in FY 2000 ($\$1,423,500 \times .608 \times .925 \times .062$).....	<u>49,636</u>
Change (FY 2000-FY 2001).....	3,748
Total adjustment-to-base	70,523

Health insurance (\$125,000) - Effective January 1999, NIST's contribution to Federal employees' health insurance premiums increased by 12.3 percent. This percentage was applied against the FY 2000 estimate.

Employees' Compensation Fund (-\$16,000) – The Employees' Compensation Fund Bill for the year ending June 30, 1999 is \$93,779 less than the bill for the year ending June 30, 1998. The ITS share is a decrease of \$15,845. The charges will be reimbursed to the Department of Labor pursuant to 5 U.S.C. 8147.

Travel and transportation of persons..... 0 47

Per Diem (\$23,000) - Effective January 1999 the General Services Administration raised per diem rates. This increase results in a 3.9 percent increase to NIST. This percentage was applied to the FY 2000 estimate.

Common Carrier (\$24,000) – An additional \$24,000 is requested to cover the cost of purchasing airline tickets in contracting with a travel agency under the new method.

Transportation of things	0	1
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The cost of transporting such things as household goods, scientific instruments, and hazardous materials increased during the past year. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate.

Rental payments to others	0	12
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An increase of \$12,000 is required to pay the increased costs of rental payments to others. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate.

Communications, utilities, and miscellaneous charges	0	41
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This adjustment to base is required to pay the additional cost of communications and miscellaneous charges. The increased costs are based on applying the 1.5 percent deflator to the FY 2000 estimated for rental of ADP equipment, office equipment, telephones, and utilities.

Printing and reproduction	0	6
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GPO has provided an estimated rate increase of 3.3 percent. This percentage was applied to the FY 2000 estimate.

Other services	0	220
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Executive Development and Leadership Training (\$35,000) – Consistent with the Department’s SES 2000 plan, an increase of \$5,000 for each currently onboard SES position is required for Executive Development and Leadership Training. An increase of \$35,000 is requested.

Working Capital Fund (GA) (\$19,000) – An additional amount of \$19,000 is required to fund cost increases in the Departmental Working Capital Fund.

Other Contracts/Services (\$302,000) - NIST is requesting \$302,000 to cover increased costs in other services. Other services include management and professional support services, training, maintenance of equipment, ADP services, and purchases of goods and services from other Federal agencies. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate for other services (excluding payments to the GA Working Capital Fund).

Supplies and materials.....	0	25
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The \$25,000 increase was calculated by applying the deflator of 1.5 percent to the FY 2000 estimate for supplies and materials.

Equipment.....	0	40
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Equipment amortization.....	30,000
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Office-ADP-Other equipment.....	10,000
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Equipment amortization (\$30,000) - An increase of \$30,000 is required to offset the effects of inflation. The increase was based on applying the GDP price deflator of 1.5 percent to the FY 2000 ITS estimate for equipment amortization. The additional appropriated funds will be allocated to the NIST operating units to finance amortization charges paid to the NIST Working Capital Fund.

Office-ADP-Other equipment (\$10,000) - The \$10,000 increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate for office machines, ADP, and other equipment.

Total, Adjustments to Base.....	0	2,003
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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Advanced technology program

<u>Line Item</u>		1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) over 2001 Base	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Advanced technology program	Pos./Approp	270	\$197,411	270	\$142,600	270	\$143,646	270	\$175,467	0	\$31,821
	FTE/Obl.	271	\$190,343	280	211,000	280	166,779	280	198,600	0	31,821

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Advanced technology program

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Advanced technology program										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	0	0	0	0	0	0	0	0	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
ADVANCED TECHNOLOGY PROGRAM

Goal Statement

The goal of this subactivity is to enhance U.S. economic growth and competitiveness by partnering with industry to support the development of innovative technologies that have widespread applicability and broad economic benefits. This work supports the DoC strategic goal to stimulate innovation for competitiveness.

Base Program

Continued innovation in American industry is crucial to sustaining U.S. global competitiveness. Technical innovations that will drive future economic growth depend upon continued investment in long-term, high-risk research today. ATP is a cost-shared partnership program that provides early-stage R&D funds to U.S. businesses and joint R&D ventures to perform high-risk research and development with broad national benefit. ATP co-funding stimulates timely corporate investment in enabling technologies that otherwise would not be developed because benefits are too widely spread; it encourages industry to take on longer-term, higher-risk projects that will sustain U.S. competitive advantage in the worldwide marketplace for high-technology products and services; and it catalyzes partnerships between companies of all sizes, universities and other research organizations to undertake research that is too costly or risky for individual companies to conduct.

ATP is open to all areas of advanced technology. ATP projects span the range of modern technology, from aquaculture to x-ray lithography, including:

- A suite of process-monitoring and control technologies that are cutting costs and improving quality throughout much of the U.S. auto industry.
- A benchtop bioreactor, now in clinical trials, capable of growing large amounts of human stem cells isolated from bone marrow for cell replacement therapy.

- A computer programming tool to simplify the task of writing software for parallel-processing computers.
- A thick-film processing technology for high-temperature superconductors to improve the quality and reduce costs of cellular phone service.
- Prototype bridge beams made of carbon- and glass-reinforced polymer composites that are lightweight, corrosion-resistant, and will improve bridge durability.

ATP funds R&D to develop high-risk, enabling technologies up to the point where it is feasible for companies to continue development and commercialization using private funds. ATP does not fund product development. Companies bear full responsibility for production, marketing, sales and distribution.

The ATP's partners include technologically advanced U.S. businesses that are able to carry out the further development of these innovative technologies, once the high-risk technical challenges are overcome, and to bring resulting products and services to market. Universities, national laboratories (excluding NIST), and independent research organizations also play integral roles, as joint venture participants or as subcontractors. Over 1,000 organizations participate as leads or formal participants in ATP awards, and roughly another 1,000 are subcontractors. Small businesses are highly successful in the ATP, both as single company applicants and as leaders of and participants in joint ventures. Over 55 percent of all projects are led by small businesses.

Each year since 1990, ATP has conducted a general competition open to proposals involving any area of technology. In FY 1994, ATP began to hold focused program competitions targeted at specific technology areas. By FY 1998, so many good ideas for focused programs were developed that ATP could not fund them all by holding a separate competition for each. Rather than select a handful of focused programs for funding and exclude the rest, ATP began using a revised competition structure in FY 1999. The FY 1999 competition was open to all areas of technology, a feature that has long been the hallmark of general competitions. Project proposals are reviewed with others in the same technology area in order to provide the best possible evaluation of their quality. This new model encourages companies to submit their many good ideas immediately, rather than wait for a focused competition.

The FY 2001 base program operating objectives include the following:

- Continue multi-year cooperative agreements selected in previous years, including real-time monitoring of the accomplishments of these projects to assure that milestones are being met.
- Conduct planned solicitations for competitions open to all areas of technology.

- Continue to implement a multi-faceted economic evaluation program, involving statistical profiling, status reports for recently completed projects, microeconomic case studies, and macroeconomic projections of long-term project and program impacts.

Performance Measures
(Total Program)

As of December 1999, 468 ATP projects have been announced (including 157 joint ventures). These awarded projects involve a commitment of over \$1.5 billion in NIST funds and \$1.5 billion in private sector funds over their lifetime. Over 100 new technologies have already been commercialized as products, processes, or services, and over 1,200 potential applications have been identified. ATP has been responsible for accelerating R&D and reducing time to market. Eighty-six percent of ATP-funded organizations have indicated they are already ahead in their R&D cycle as a result of ATP funding, and acceleration in time-to-market by two years or more is anticipated for 62 percent of planned commercial applications. These results are documented in *Development, Commercialization, and Diffusion of Enabling Technologies, Progress Report for Projects Funded 1993-1995*, one of a series of studies resulting from ATP's evaluation and analysis efforts.

As described in the NIST Executive Summary, ATP assesses its performance through a combination of metrics including output tabulations, assessments of interim outcome indicators, and studies of long-term economic impacts. Assuming stable funding, ATP estimates the following performance results for key outputs and interim outcome indicators that can be tracked annually:

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
• Cumulative number of technologies under commercialization	120	170	200	210	240	280	330
• Percent of projects reporting an increase in longer-term and/or higher risk R&D	95	95	95	95	95	95	95
• Percent of projects involving R&D collaboration	85	85	85	85	85	85	85
• Percent of project participants reporting acceleration of R&D cycle time	85	85	85	85	85	85	85

• Cumulative number of publications	480	680	790	820	960	1,110	1,310
• Cumulative number of patents filed	640	770	920	1,040	1,220	1,400	1,630
• Number of project participants licensing their technology (patent and software licensing)	70	100	110	120	140	170	200

ATP economic impact assessments, both independent and internal, are conducted to assess progress towards commercialization, technology diffusion, and generation of spillover benefits and to estimate private and social benefits relative to costs. The long time period from ATP funding to economic impacts creates substantial market and technological uncertainties at the point early impact studies are undertaken. Few projects are sufficiently mature to assess their long-term impacts *ex post*. Consequently, in some cases projections are used to estimate outcomes and potential economic impacts; this was the approach taken in a study of the potential economic benefits associated with ATP funding of medical technologies and in a study of flow-control machining and rapid precision measurement in discrete parts manufacturing. Additional studies to improve evaluation methods and metrics are underway.

To complement economic assessments, ATP also generates Status Reports of all completed projects. The first Status Report was published in March 1999 and reports on all ATP projects completed as of March 1997. This report paints a portrait of a program that works. Twenty-four of the 38 completed projects have a new process, product or service in the marketplace; independent economic studies forecast that benefits from just three of the 38 projects in the report could exceed the total costs of the program to date; and of the 27 small, single-applicant companies, nearly 60 percent have more than doubled in size. In addition, patents have been granted for the technologies developed by 40 percent of the projects and others had been filed but not yet granted. The results are documented in *Advanced Technology Program Performance of Completed Projects, Status Report Number 1*.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/(Decrease) Over 2001 Base</u>	
		<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Advanced technology program.....	Pos./Approp	270	\$143,646	270	\$175,467	0	\$31,821
	FTE/Obl.	280	166,779	280	198,600	0	31,821

Advanced technology program (BA +\$31,821,000, Direct Obligations +\$31,821,000) – ATP co-funds partnerships with the private sector to develop high-risk, enabling technologies that support long-term U.S. economic growth and industrial productivity. ATP accelerates R&D, reduces time to market, and broadens the scope of R&D projects. ATP’s cost-shared projects enable novel and/or greatly improved products and services with the potential for broad-based economic impact. To date, ATP’s cost-shared projects involved more than 1,000 formal participants and another 1,000 subcontractors, including companies of all sizes, universities, and other research organizations. In the selection of its projects, ATP is size-blind – to illustrate this, over half of ATP awards have gone to small businesses.

This increase, when combined with anticipated carryover and prior-year recoveries, provides \$65 million to fund approximately 65 new projects in FY 2001. The increase addresses the DoC goals to promote economic growth, stimulate innovation for competitiveness, and advance sustainable economic development. The President's technology policy states that “the Nation urgently needs improved strategies for government/industry cooperation in the support of industrial technology.” The ATP directly responds to that need. With additional resources, the ATP can leverage more private R&D dollars and broaden its impact on the economy across a greater spectrum of technologies.

This increase supports the DoC strategic goal to stimulate innovation for competitiveness. It also supports Administration goals to “sustain and nurture America’s world-leading science and technology enterprise... and focus on activities that require a Federal presence to attain... economic growth and prosperity...” [Neal Lane and Jacob Lew, April 22, 1999, FY2001 Interagency Research and Development Priorities]. The ATP further supports the stated goals within the same memorandum to “maximize the efficiency and effectiveness of Federal R&D investments, for example by: favoring activities that employ competitive, peer-reviewed processes” and “encouraging collaboration among agencies, industry, [and] academia...”

Problem Magnitude and NIST Role:

Continued innovation in American industry is crucial to sustaining U.S. global competitiveness. Technical innovations that will drive future economic growth depend upon continued investment in long-term, high-risk research today. In today’s competitive climate, private industry’s research priorities do not completely focus on the high-risk, enabling R&D that will contribute to continued U.S. technological leadership throughout the world. The ATP stimulates industry investment in innovative technology with the potential for broad national benefit by addressing sources of market failure. To address these market failures, ATP provides co-funding that: facilitates timely private sector investment in broad-based, enabling technologies that otherwise would not be developed because benefits are too widely spread; challenges industry to take on longer-term, higher-risk projects that will sustain U.S. competitive advantage in the worldwide marketplace for high-technology products and services; and catalyzes partnerships between companies of all sizes, universities and other research organizations to undertake research which is too costly or risky for any single company to address on its own.

The ATP is a well-managed, effective program. It has developed a rigorous selection process which industry enthusiastically supports. In addition, a rigorous evaluation process begins during the first year of each award and continues for six years beyond completion of the project.

NIST is the agency best equipped to pursue this mission because of the technical expertise of its staff and its long history of partnership with industry. NIST coordinates effectively with other Federal agencies involved in technology development to ensure that the ATP does not duplicate their efforts. The ATP has close working relationships with the Defense Advanced Research Projects Agency, the National Science Foundation, the National Institutes of Health, the National Aeronautics and Space Administration, the Department of Energy, and others. ATP projects sometimes leverage the basic research funded by other agencies.

Proposed NIST Technical Program:

The proposed increase, when combined with anticipated carryover and prior-year recoveries, will provide \$65 million for new awards, which will permit the ATP to initiate a total of approximately 65 new industry-led R&D projects while continuing ongoing projects. New projects, which leverage a private-sector investment at least as large as the Federal expenditure, accelerate development of new technologies that will underpin continued U.S. competitiveness in world markets. To select projects, ATP will conduct at least one peer-reviewed competition during FY 2001, to which companies of all sizes are encouraged to submit innovative R&D ideas across all areas of technology.

Performance Measures: Outputs

ATP is in its tenth year, and evidence shows that the program is working. ATP has been responsible for accelerating R&D and reducing time to market. In addition, acceleration in time-to-market by two years or more is anticipated for 62 percent of planned commercial applications. Over 100 new technologies have been commercialized as products, processes, or services, and over 1,200 potential applications have been identified.

A status report on the first 38 completed projects paints a portrait of a program that works [W.F. Long, Performance of Completed Projects, March, 1999]. Twenty-four of those projects have a new process, product or service in the marketplace. Two-thirds of the companies stated that they would not have proceeded at all without ATP support, and the others reported research acceleration of a year and a half or more. Of the 27 small, single-applicant companies, nearly 60 percent have more than doubled in size.

Performance Measures: Outcomes

Economic studies forecast that the potential benefits from just three of the early ATP projects will likely exceed the total costs of the program to date. They also show interim impacts, such as research cost savings and reduced production and maintenance costs.

Many ATP projects are still very much in the research or pre-development phase, but others are already producing breakthrough technologies that are being commercialized. Examples of project developments include the following advances:

- low-cost, hand-held DNA diagnostic devices that can analyze biological samples quickly, accurately and inexpensively enough for routine use in doctors' offices. Initial spinoff systems increase the speed of genetic analysis 1,000-fold. The technologies

have the potential to diffuse beyond biomedical research to other fields, such as food testing and agriculture, in which DNA diagnostics may be applied.

- new software technology for advanced process control that enhances productivity and yield in semiconductor manufacturing, helping to bring microprocessors to market sooner and giving U.S. firms a global edge in process control. This software enabled one company to save over \$10 million in one quarter by its implementation in one production step at one facility.
- fast, flexible spindles that break new ground in machine tool performance. One design, which won an R&D 100 award, has the potential to save more than \$6 million annually in the production of a single part. Although the initial work was focused on the needs of the auto industry, benefits could extend to aircraft, appliance, electronics, oil and other sectors.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Extramural programs

Subactivity: Advanced technology program

Program Change: Advanced technology program

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$0
11.9 Total personnel compensation	0
12.1 Civilian personnel benefits	0
21 Travel and transportation of persons	0
22 Transportation of things	0
23.3 Communications, utilities and miscellaneous charges	0
24 Printing and reproduction	0
25.1 Advisory and assistance services	0
25.2 Other services	0
25.3 Purchases of goods and services from Government accounts	0
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	0
26 Supplies and materials	0
31 Equipment	0
32 Land and structures	0
41 Grants, subsidies and contributions	31,821
99 Direct obligations	<hr/> 31,821
Transfer to NIST Working Capital Fund	0
Total increase requested	<hr/> 31,821

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Manufacturing extension partnership

<u>Line Item</u>		<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) over 2001 Base</u>	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Manufacturing extension partnership	Pos./Approp	107	\$106,768	109	\$104,180	109	\$105,137	107	\$99,137	(2)	(\$6,000)
	FTE/Obl.	89	127,901	113	105,081	113	105,137	111	99,137	(2)	(6,000)
Electronic commerce	Pos./Approp	0	0	0	0	0	0	4	15,000	4	15,000
	FTE/Obl.	0	0	0	0	0	0	3	15,000	3	15,000
Total	Pos./Approp	107	106,768	109	104,180	109	105,137	111	114,137	2	9,000
	FTE/Obl.	89	127,901	113	105,081	113	105,137	114	114,137	1	9,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Manufacturing extension partnership

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Manufacturing extension partnership										
Direct obligations		0		0		0		0		0
Reimbursable FTE/Obl	<u>20</u>	<u>\$3,509</u>	<u>0</u>	<u>\$890</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	20	3,509	0	890	0	0	0	0	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
MANUFACTURING EXTENSION PARTNERSHIP

Goal Statement

The goal of this subactivity is to improve the technological capability, productivity, and competitiveness of small manufacturers. To realize this goal, the Manufacturing Extension Partnership (MEP) provides small- and medium-sized manufacturers (those with fewer than 500 employees) throughout the United States with information, decision support, and implementation assistance in adopting advanced manufacturing technologies, techniques, and business best practices. This program also supports the DoC strategic goal to promote economic growth.

Base Program

MEP provides small- and medium-sized U.S. manufacturers with access to technologies, resources, and expertise through cost-shared cooperative efforts between NIST, state and local governments, and local extension service providers. The MEP program consists of a nationwide network of regional manufacturing extension centers which are linked to diverse Federal, state, university, and private sources of technology and expertise. Each center uses the MEP network to design and provide the most appropriate and cost-effective assistance to small- and medium-sized businesses in such areas as best manufacturing and business practices, workforce development and training, access to sources of financing, and environmental services. Centers can also use tools and techniques developed throughout the MEP network to improve the quality and efficiency of their services, which enable them to serve more firms, provide higher value added services, and increase their overall impact on small- and medium-sized manufacturers in the United States.

MEP has succeeded in its initial goal of placing critically needed extension services within reach of small- and medium-sized manufacturers in all 50 States and Puerto Rico. Therefore, MEP has now turned its focus to making an even more significant contribution to the health of the economy by increasing market penetration and the effectiveness of its services to small- and medium-sized manufacturers as they improve their equipment, processes, and practices to improve capabilities, performance, and prospects for growth.

Guided by MEP's strategic plan, two significant efforts have been initiated to further advance the goal of increasing the competitiveness of small- and medium-sized manufacturers. First, the NIST Baldrige National Quality Program evaluation criteria have been adapted as a framework for generating continuous improvement in center performance and impact. By creating high performance centers responsive to the most pressing challenges and needs confronting large numbers of small- and medium-sized manufacturers, MEP is significantly improving manufacturing competitiveness throughout the U.S. Second, an integrated knowledge management system is being developed to facilitate the sharing of best business practices among the centers, deploy proven solutions and technologies to solve industry problems faster and reach more companies, and decrease the cost of service development and training for the centers.

Extending the network's reach is also critical, and the number of small manufacturers receiving services annually by MEP centers continues to grow. In FY 1999, established centers and field offices provided assistance to approximately 26,662 small- and medium-sized enterprises (SMEs). MEP will continue to focus on optimizing system and center performance, thereby increasing its ability to serve more small- and medium-sized U.S. manufacturers, including those in severely under served urban and rural areas.

MEP provides a distributed pool of resources, tools, and techniques that integrate and leverage its nationwide network of more than 400 regional locations. Integrating these 400 dispersed units into a cohesive system adds value to the individual manufacturing extension centers, minimizes duplication of effort, and fosters collective learning. MEP's system-enhancing efforts include: supporting the training and development needs of field agents and other center staff with a broad array of technical and service courses; establishing Internet linkages between centers and value-added resource affiliates; and providing tools that assist network affiliates in building their capabilities to assist small- and medium-sized manufacturers (for example, responding cost-effectively to environmental requirements or improving workforce skills). MEP also disseminates uniform evaluation metrics; designs/oversees all legislatively mandated program evaluations; and responds to inadequately addressed or future manufacturer needs, such as the Y2K problem.

The FY 2001 base program operating objectives for the MEP include the following:

- Work with the manufacturing extension centers and state and local governments to further develop their industrial extension infrastructure to increase capabilities and effectiveness and enhance the integration of the nationwide network of centers, while reaching more manufacturing customers.
- Conduct annual and bi-annual reviews, renew agreements, and manage the nationwide network of MEP-funded manufacturing extension centers.
- Collect and evaluate performance data on the manufacturing extension centers and the impact of their services on client firms.

- Further develop the electronic networking and information capabilities of the MEP system to strengthen center-to-center and center-to-technology resource communications.

Performances Measures
(Total Program)

As described in the NIST General Statement, MEP evaluates its performance through a combination of methods including: 1) independent assessment of MEP programs, plans, and policies by the MEP National Advisory Board; 2) legislatively mandated independent panel reviews of individual MEP center operations and outcomes conducted against criteria adapted from the Malcolm Baldrige National Quality Award; and 3) regular program oversight and periodic review of individual MEP center operations and outcomes by NIST staff. These reviews and assessments utilize a variety of metrics, including output tabulations (such as the number of companies served and the number of activities completed); interim impacts on client competitiveness (such as increased sales, capital investment, and cost savings), which are derived from regular surveys conducted by the Bureau of the Census; special studies of program effectiveness and economic impacts; and analysis of more detailed information regarding the operations and performance of individual centers. Estimated values for key output and interim outcome indicators are provided below: ¹

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>	<u>FY 2005</u>
• Companies served by MEP managed extension services ²	26,662	30,125	33,625	37,125	38,000	38,000	38,000
• Client activities completed by MEP centers ²	34,569	36,163	43,713	48,263	49,400	49,400	49,400
• Increased sales (\$ in millions) ³	443	595	748	914	981	989	989
• Labor and material savings (\$ in millions) ³	45	60	76	93	99	100	100
• Capital investment (\$ in millions) ³	359	483	607	741	796	802	802
• Inventory reductions (\$ in millions) ³	33	44	56	68	73	74	74

¹ Reflects updated data as of September 1999.

² Anticipated increases for companies served and activities completed for FY 1999 and beyond are based on actual increases between FY 1997 and FY 1998 and MEP's goal of increasing the system-wide utilization rate.

³ Data represent the impacts that projects closing in each year can be expected to have within ten months, based on U.S. Census Bureau client surveys. Because it is a snapshot of actual impacts that companies attribute directly to MEP services within ten months of receiving services, this technique does not measure cumulative or recurring benefits. Actual data for 1999 are not yet available.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
DECREASE FOR FY 2001
(Dollar amounts in thousands)

		2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Manufacturing extension partnership.....	Pos./Approp	109	\$105,137	107	\$99,137	(2)	(\$6,000)
	FTE/Obl.	113	105,137	111	99,137	(2)	(6,000)

MEP Base reduction (-2 Permanent Positions, -2 FTE, BA -\$6,000,000, Direct Obligations -\$6,000,000,) – A decrease of -\$6,000,000 is proposed to reflect a redirection of funds to support E-commerce Outreach to small- and medium-sized manufacturers, while continuing to maintain the appropriate level of match funding for the MEP centers.

There are many additional services which MEP could provide to help small businesses improve their capabilities, performance, and prospects for growth. However, the most critical issue facing U.S. small- and medium-sized businesses today is e-commerce. Research indicates that many small businesses have not fully embraced e-commerce, and experts predict that companies will likely fail if they do not strategically transform their business processes to include e-commerce. Redirection of these funds to the E-commerce Outreach initiative requested in this budget will help to support MEP's participation in a joint, coordinated outreach program that will be carried out by the U.S. Department of Commerce (DoC), Small Business Administration (SBA), and the U.S. Department of Agriculture (USDA) Cooperative Extension Service that will help U.S. small businesses adopt the e-commerce business model, and ultimately improve their competitive position in the world marketplace.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Extramural programs
Subactivity: Manufacturing extension partnership
Program Change: MEP base reduction

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Information specialist	ZA IV	(1)	71,861	(71,861)
Social scientist	ZP IV	(1)	71,861	(71,861)
Subtotal		<u>(2)</u>		<u>(143,723)</u>
Less lapse	0 %	0		0
Total full-time permanent (FTE)		<u>(2)</u>		<u>(143,723)</u>
2001 Pay Adjustment (0.0%)				0
Total				<u>(143,723)</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		(2)		
Authorized Positions:				
Full-time permanent		(2)		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Extramural programs

Subactivity: Manufacturing extension partnership

Program Change: MEP base reduction

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	(\$144)
11.9 Total personnel compensation	(144)
12.1 Civilian personnel benefits	(35)
21 Travel and transportation of persons	(15)
22 Transportation of things	(2)
23.3 Communications, utilities and miscellaneous charges	(35)
24 Printing and reproduction	(4)
25.1 Advisory and assistance services	0
25.2 Other services	(105)
25.3 Purchases of goods and services from Government accounts	(23)
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	(10)
26 Supplies and materials	(22)
31 Equipment	(3)
32 Land and structures	0
41 Grants, subsidies and contributions	(5,602)
99 Direct obligations	<u>(6,000)</u>
Transfer to NIST Working Capital Fund	0
Total increase requested	<u>(6,000)</u>

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

		2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Electronic commerce.....	Pos./Approp	0	0	4	\$15,000	4	\$15,000
	FTE/Obl.	0	0	3	15,000	3	15,000

Electronic Commerce Outreach Program (+4 Permanent Positions, +3 FTE, BA +\$15,000,000, Direct Obligations +\$15,000,000) – To enable NIST’s Manufacturing Extension Partnership (MEP) to help U.S. small businesses succeed by promoting the use of electronic commerce and increasing information dissemination. This initiative is the NIST portion of a coordinated outreach program that will be carried out by the U.S. Department of Commerce, Small Business Administration, and the U.S. Department of Agriculture (USDA) Cooperative Extension Service, in accordance with the President’s Directive on Electronic Commerce and Policy Statement issued November 29, 1999. This work also supports the DoC Secretarial priority on Accelerating the Transition to Electronic Commerce.

To develop outreach capabilities and capacity, NIST/MEP will develop, produce, and distribute the contents of the Electronic Commerce (EC) Jump-Start Kit and EC training curriculum. An e-commerce assessment tool and other materials for the EC Jump-Start Kit would be developed and beta tested within the MEP system. Work will also begin on EC Adoption Kits for small businesses. These tools will focus on building initial e-commerce awareness, completing e-commerce assessments, planning for e-commerce adoption, identifying necessary resources, and completing e-commerce implementations. It will also set a broader foundation allowing for work to begin on more advanced, industry sector focused, business-to-business e-commerce Adoption Kits in subsequent years.

This initiative will provide continued funding for approximately 200 Information Technology (IT) professionals that were added by MEP Centers to execute the Y2K outreach program. These professionals will provide the technical capabilities and capacity necessary to assist small- and medium-sized enterprises (SMEs) with e-commerce planning and strategy development, architecture assessment and design, Internet design and development, systems integration and implementation, and security. These staff resources will be

trained by NIST in the use of tools and other materials developed by NIST/SBA/USDA to provide services in the technical areas demanded by SMEs.

In support of the resources and tools developed by NIST, the existing Y2K Help Center will be migrated into an e-commerce Solutions Center for Small Business, to provide technical assistance to interagency outreach field staff and small businesses utilizing the e-commerce Jump-Start Kit and related tools. The Solutions Center will also support additional tools, workshops and related training material, and revise existing materials as needed.

Small businesses face critical challenges in the rapidly advancing environment of the digital economy because many of them lack the resources and expertise to adopt e-commerce business practices. No company, regardless of size, can afford to miss out on the opportunities offered by the application of telecommunications and information technologies to their business processes. Through this initiative, NIST/MEP and the other participating agencies will fill an unmet need by helping to build awareness of the benefits, as well as creating and demonstrating self-assessment and adoption tools.

Problem Magnitude and NIST Role:

The Internet is rapidly reshaping the global marketplace, but not all U.S. firms are able to participate. Many companies are jumping into the marketplace with packages promising to turn businesses into e-businesses, however, these packages often only address the simplest aspects of e-commerce, such as retail over the Internet.

Over 50 percent of all supply-chain participants are small businesses, making it extremely important to trading partners that small firms be capable of using e-commerce technology. Unfortunately, research indicates that small businesses have not strategically embraced e-commerce. Many experts predict that companies will likely fail if they do not strategically transform their business processes to include e-commerce.

Small businesses face numerous barriers to adopting e-commerce including serious misconceptions about the technology, along with the lack of available, affordable solutions, and qualified integration assistance.

MEP plays a key role in supporting e-commerce deployment in the U.S. NIST's MEP has the only nationwide service delivery system of its kind, public or private. It is being called upon more frequently by the Federal government to reach small- and medium-sized enterprises.

NIST/MEP has demonstrated its ability to transfer technologies and techniques such as quality improvement, materials selection, and inventory reduction to SMEs. MEP has also demonstrated its ability to link SMEs with organizations that provide services in the business activities that support technology adoption, such as business and strategic planning, workforce organization and training, environmental compliance, and Y2K readiness.

In addition, NIST/MEP has developed a valuable strategy of partnering with other government organizations including the USDA, EPA, DoD, DoE, SBA, DoL, and DoC/NOAA. MEP has partnered with USDA and SBA to distribute an extremely successful Y2K tool developed by MEP to assist businesses in addressing their Y2K issues. These partnerships have demonstrated that the NIST/MEP provides an efficient delivery system.

Proposed NIST Technical Program:

At the proposed funding level, NIST will focus on small business outreach to enhance access to information and services that will assist small businesses' development by using the Internet and e-commerce. The interagency Y2K outreach model (working cooperatively with the SBA, USDA Cooperative Extension Service and Office of Small and Disadvantaged Business Utilization, DoC/ITA, DoC/MBDA, GSA, and DoD) will be utilized for the delivery of e-commerce assistance to small businesses.

Field staff training will be accomplished through the train-the-trainer workshop model that has been utilized effectively within the Y2K outreach program. The completion of training will facilitate the rollout of the Jump-Start, multiple Adoption Kits, and workshop materials to small businesses. In order to migrate the existing interagency Y2K outreach model to an interagency e-commerce outreach program, MEP will lead the development of tools, materials and hands-on assistance by leveraging participating agencies' contributions.

Performance Measures: Outputs

At the proposed funding level, NIST MEP will generate the following outputs:

Electronic Commerce Initiative	
Technical Area	Outputs
Develop e-commerce Jump-Start Kits, Assessment Tools, and Roadmap	<ul style="list-style-type: none">• Complete development of Jump-Start Kit contents within first year.
Conduct e-commerce training and distribute Jump-Start and Adoption Kits	<ul style="list-style-type: none">• Distribute 600,000 toolkits to MEP centers, USDA cooperative extension offices, small business development centers, and SBA offices within first year.• Train 600 IT field personnel from MEP Centers, USDA cooperative extension offices, small business development centers, and SBA offices per year.

Performance Measures: Outcomes

At the proposed funding level, NIST will generate the following outcomes:

- increased number of small manufacturing businesses utilizing e-commerce technologies;
- increased survival rate and competitiveness of small businesses within manufacturing supply chains; and
- lower costs and improved supply chain efficiency.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Extramural programs
Subactivity: Manufacturing extension partnership
Program Change: E-commerce outreach

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer specialist	ZP V	1	84,530	84,530
Computer specialist	ZP IV	1	71,861	71,861
Computer specialist	ZP III	1	51,138	51,138
Administrative/technical support	ZA II	1	35,265	35,265
Subtotal		<u>4</u>		<u>242,794</u>
Less lapse	25 %	(1)		(60,699)
Total full-time permanent (FTE)		<u>3</u>		<u>182,095</u>
2001 Pay Adjustment (3.7%)				6,738
Total				<u>188,833</u>
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		3		
Authorized Positions:				
Full-time permanent		4		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Extramural programs

Subactivity: Manufacturing extension partnership

Program Change: E-commerce outreach

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$189
11.9 Total personnel compensation	189
12.1 Civilian personnel benefits	46
21 Travel and transportation of persons	65
22 Transportation of things	0
23.3 Communications, utilities and miscellaneous charges	28
24 Printing and reproduction	8
25.1 Advisory and assistance services	0
25.2 Other services	4,351
25.3 Purchases of goods and services from Government accounts	1,515
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	6
26 Supplies and materials	24
31 Equipment	8
32 Land and structures	0
41 Grants, subsidies and contributions	8,760
99 Direct obligations	<hr/> 15,000
Transfer to NIST Working Capital Fund	0
Total increase requested	<hr/> 15,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Manufacturing Extension Partnership
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
Department of Defense			
Other	<u>\$1,826</u>	<u>\$514</u>	<u>\$0</u>
Subtotal, Department of Defense	1,826	514	0
Department of Labor	196	0	0
Environmental Protection Agency	287	376	0
Other	<u>1,200</u>	<u>0</u>	<u>0</u>
Total, Other Agency	3,509	890	0
WCF Investments/Operating Adjustments	<u>0</u>	<u>0</u>	<u>0</u>
Total, Other Reimbursables	0	0	0
Grand Total, Reimbursable Program	3,509	890	0

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Institute for information infrastructure protection

<u>Line Item</u>		1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) over 2001 Base	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Institute for information infrastructure protection	Pos./Approp	0	0	0	0	0	0	42	\$50,000	42	\$50,000
	FTE/Obl.	0	0	0	0	0	0	31	48,400	31	48,400

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
PROGRAM AND PERFORMANCE: REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Institute for Information Infrastructure Protection

<u>Line Item</u>	<u>1999 Actual</u>		<u>2000 Currently Available</u>		<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/ (Decrease) Over 2001 Base</u>	
	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>	<u>FTE</u>	<u>Amount</u>
Institute for Information Infrastructure Protection										
Direct obligations		0		0		0		\$1,600		\$1,600
Reimbursable FTE/Obl	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	0	0	0	0	0	0	0	1,600	0	1,600

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
JUSTIFICATION OF PROGRAM AND PERFORMANCE
INSTITUTE FOR INFORMATION INFRASTRUCTURE PROTECTION

Goal Statement

The goals of this program are to (1) establish and operate an Institute to support research and development for protection of the Nation's critical information infrastructures by working directly with industry and universities through the provision of research grants, and (2) assist the Critical Infrastructure Coordinating Group (CIG) and the National Science and Technology Council with the coordination of information infrastructure protection R&D efforts across agencies.

The Institute will fill research and other key technical gaps that neither the private sector nor the government's existing programs would address, but that must be filled to ensure the robust, reliable operation of the national information infrastructure. This work supports the Presidential Decision Directive (PDD) #63, dated May 22, 1998, and also supports the DoC Secretarial priority on Establishing Safeguards Against Unconventional National Security Threats.

Base Program

The initiative that follows would establish the Institute for Information Infrastructure Protection budget subactivity and program at NIST. Therefore, at the present time, there is no base program for this budget subactivity.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
INCREASE FOR FY 2001
(Dollar amounts in thousands)

		2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
		Personnel	Amount	Personnel	Amount	Personnel	Amount
Institute for information infrastructure protection (IIIP)							
	Pos./Approp	0	0	42	\$50,000	42	\$50,000
	FTE/Obl.	0	0	31	48,400	31	48,400

Institute for information infrastructure protection (IIIP) (+42 Permanent Positions, +31 FTE, BA +\$50,000,000, Direct Obligations +\$48,400,000, Transfer to WCF +\$1,600,000) - To establish and operate an Institute to support research and development for protection of the Nation's critical information infrastructures by collaborating with industry and universities through the provision of research grants. The Institute will also assist with the coordination of agency-specific information infrastructure protection R&D efforts. This work supports the Presidential Decision Directive (PDD) #63, dated May 22, 1998, and also supports the DoC Secretarial priority on Establishing Safeguards Against Unconventional National Security Threats. IIIP has its roots in a 1998 recommendation of the President's Committee of Advisors on Science and Technology (PCAST). That group recommended that the Federal government consider creating, in conjunction with the private sector, a new not-for-profit public-private Institute that would develop and disseminate the knowledge necessary to protect the national information infrastructures. As discussed in the National Plan for Information Systems Protection prepared to coordinate implementation of PDD #63, "In R&D and other key technical areas, neither the private sector market demands nor Agency mission objectives fully meet the Nation's requirements." IIIP will fill this need by developing the knowledge and technology base to protect the national information infrastructure. The Institute, to be funded through NIST, will lead a partnership among industry, academia, and government for this purpose.

The PDD #63 was based on intense interagency effort and used the final report (October 1997) of the President's Commission on Critical Infrastructure Protection as input. The PDD identifies government and private telecommunications, energy, financial, transportation, water, and emergency services systems as among the critical infrastructures vulnerable to equipment failure, human

error, disruption by natural causes, and physical and cyber attacks. As these systems become more interdependent through information technology links, disruption of part of one system can lead to catastrophic effects on large parts of the Nation.

Problem Magnitude and NIST Role:

Vulnerabilities affecting the information and communications infrastructure have the potential to affect the entire U.S. economy, not just a single sector or industry. Consequently, there is a substantial need for significant new research into technology, measurements, and methods that can raise the level of reliability and security of the information technology-based systems and networks that comprise the backbone of every critical national infrastructure. Supporting such R&D is the central mission of the Institute.

Proposed NIST Technical Program:

This Institute initiative is designed to identify and fill the gaps on Federal and private sector investments in R&D for CIP and provide a strong and secure foundation to protect the various critical infrastructures upon which the Nation's security and economy rely. The Institute's R&D will include work that can be applied to protect multiple sectors' infrastructures, and thus will complement sector-specific CIP R&D underway elsewhere in the government and private sector. This initiative will help strengthen the focused existing and planned security architectures within the critical infrastructure sectors and help prepare the owners/operators of those infrastructures to survive potential hostile activities. The Institute will be a partnership among industry, academia and the government (including both state and local governments). At the core of the partnership is the Institute's selection of information infrastructure protection R&D focus areas, which will rely heavily on advice and guidance obtained from outside experts.

IIIP's success depends on effectively meeting the needs of multiple constituencies: relevant government agencies, owners/operators of information infrastructures, IT providers, academia, and companies and communities that rely on critical infrastructures. To meet these needs, the Institute is designed to (1) have a small in-house staff, (2) supplement, not absorb, existing research, and (3) have close working ties to both industry and concerned Federal agencies.

The Institute will complement NIST's current and planned activities for CIP, including developing Federal standards and guidelines and measurements and standards to support this activity. These efforts support the improvement of the security, reliability, and survivability of information infrastructure assets. In addition, PDD #63 requires that each Federal department and agency reduce its exposure to new security threats and requires the Federal government to serve as a model to the rest of the country. NIST has the responsibility and requisite technical base to address many of the needs of Federal agencies in protecting their critical systems. The Institute will enhance and build upon this foundation of NIST experience and expertise.

The Institute's headquarters will be responsible for development and maintenance of its knowledge base for the timely and effective dissemination of its R&D products. It will also coordinate and fund the necessary R&D in the area of information infrastructure measurements and standards to be accomplished at NIST. It will also work to identify potential customers for the Institute's work, continually seek out other communities and experts who may contribute to the Institute's activities and make provisions for accepting support, including personnel from the private sector. The Institute will engage other Federal agency-based CIP research efforts to identify opportunities for synergistic cooperation, help disseminate NIST and other agency CIP R&D work, and ensure avoidance of duplication of effort.

Performance Measures: Outputs

The 'products' of the Institute will be funded R&D technology, tools, standards, and tests that will support protection of the national information infrastructure. At the proposed funding level, the Institute will produce the following outputs:

Institute for Information Infrastructure Protection (IIIP) Initiative	
Technical Area	Outputs
Institute Formation	<ul style="list-style-type: none"> • Develop a detailed Institute operations plan. • Establish an Institute and hire staff. • Establish advisory and Federal oversight mechanisms. • Recommend program areas/specific projects. • Integrate Academic and Industry Guest Researchers to Institute operations. • Develop appropriate indicators of Institute service and impact.
Institute Activities	<ul style="list-style-type: none"> • List and disseminate research results annually, such as tools and other R&D products. • Establish web-based forum to strengthen partnership and widely engage industry and academic communities in information infrastructure R&D and provide input to advisors. • Select Federal experts to serve on source selection panels. • Fund extramural and intramural research activities. • Consult with Federal agencies on their sensitive and critical systems.

Performance Measures: Outcomes

American taxpayers will benefit by the Institute's R&D activities through greater protection and reliability of the services that perform essential national missions, ensure the general public health and safety, support other essential government programs, and ensure orderly functions of the economy.

At the proposed funding level, successful completion of the work described in the initiative will:

- Provide new technology, standards, methods and tests to support CIP;
- Help protect the Nation against economic loss or injury to citizens related to disruption of critical infrastructures; and
- Enhance the government's security posture for information infrastructure systems by improving compliance with government-wide security requirements.

In addition, advancements in infrastructure protection will reduce the level of ongoing loss (fraud, waste, and abuse) by "lower-level" attacks and failures in the information and communications infrastructure. Since there are thousands of other organizations making extensive use of IT, and because this figure does not reflect indirect costs or costs of entire infrastructure failure, it is clear that the potential cost of losses given the current situation is enormous and enhanced protection could avoid significant costs.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Extramural programs
Subactivity: Institute for information infrastructure protection
Program Change: Institute for information infrastructure protection

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer specialist	ZP V	6	84,530	507,180
Physical scientist	ZP V	3	84,530	253,590
Program deputy director	ZP V	1	84,530	84,530
Program director	ZP V	1	84,530	84,530
Senior management advisor	ZA V	1	84,530	84,530
Computer specialist	ZP IV	13	71,861	934,193
Physical scientist	ZP IV	3	71,861	215,583
Information specialist	ZA III	3	51,138	153,414
Mathematician	ZP III	5	51,138	255,690
Secretary	ZS V	1	38,836	38,836
Administrative officer	ZA II	1	35,265	35,265
Administrative/technical support	ZA II	3	35,265	105,795
Secretary	ZS IV	1	31,927	31,927
Subtotal		42		2,785,063
Less lapse	25 %	(11)		(697,266)
Total full-time permanent (FTE)		31		2,087,797
2001 Pay Adjustment (3.7%)				77,286
Total				2,165,083
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		31		
Authorized Positions:				
Full-time permanent		42		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Extramural programs

Subactivity: Institute for information infrastructure protection

Program Change: Institute for information infrastructure protection

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$2,165
11.9 Total personnel compensation	2,165
12.1 Civilian personnel benefits	529
21 Travel and transportation of persons	686
22 Transportation of things	210
23.3 Communications, utilities and miscellaneous charges	674
24 Printing and reproduction	195
25.1 Advisory and assistance services	0
25.2 Other services	1,367
25.3 Purchases of goods and services from Government accounts	1,713
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	130
26 Supplies and materials	355
31 Equipment	376
32 Land and structures	0
41 Grants, subsidies and contributions	40,000
99 Direct obligations	<hr/> 48,400
Transfer to NIST Working Capital Fund	1,600
Total increase requested	<hr/> 50,000

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Institute for Information Infrastructure Protection
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
 (Dollar amounts in thousands)

	<u>FY 1999 Actual</u>	<u>FY 2000 Estimate</u>	<u>FY 2001 Estimate</u>
WCF Investments/Operating Adjustments	<u>\$0</u>	<u>\$0</u>	<u>\$1,600</u>
Total, Other Reimbursables	0	0	1,600
 Grand Total, Reimbursable Program	 0	 0	 1,600

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

Object Class	1999 Actual	2000 Currently Available	2001 Base	2001 Estimate	Increase/ (Decrease) over 2001 Base
11 Personnel compensation					
11.1 Full-time permanent	\$21,844	\$24,657	\$25,793	\$28,003	\$2,210
11.3 Other than full-time permanent	1,720	1,753	1,782	1,782	0
11.5 Other personnel compensation	583	583	583	583	0
11.9 Total personnel compensation	24,147	26,993	28,158	30,368	2,210
12.1 Civilian personnel benefits	4,690	5,362	5,795	6,335	540
13 Benefits for former personnel	11	11	11	11	0
21 Travel and transportation of persons	1,525	1,559	1,606	2,342	736
22 Transportation of things	126	130	131	339	208
23.1 Rental payments to GSA	17	17	17	15	(2)
23.2 Rental payments to others	656	660	671	671	0
23.3 Communications,utilities, and miscellaneous charges	2,534	2,602	2,646	3,313	667
24 Printing and reproduction	199	207	213	412	199
25.1 Advisory and assistance services	3,721	3,728	3,764	3,764	0
25.2 Other services	11,664	9,554	9,700	15,314	5,614
25.3 Purchases of goods and services from Government accounts	6,006	6,530	6,568	9,774	3,206
25.5 Research and development contracts	54	55	55	55	0
25.7 Operation and maintenance of equipment	242	250	261	387	126
26 Supplies and materials	1,911	1,939	1,964	2,321	357
31 Equipment	2,875	2,890	2,930	3,311	381
32 Land and structures	66	66	66	66	0
41 Grants, subsidies and contributions	257,797	253,525	207,357	282,336	74,979
42 Insurance claims and indemnities	3	3	3	3	0
99 Total obligations	318,244	316,081	271,916	361,137	89,221

<u>Object Class</u>		<u>1999 Actual</u>	<u>2000 Currently Available</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
99	Total obligations	318,244	316,081	271,916	361,137	89,221
	Less: prior year unobligated balance	(33,408)	(68,634)	(19,333)	(19,333)	0
	Less: prior year recoveries	(28,291)	(20,000)	(3,800)	(3,800)	0
	Less: MEP supplemental	(21,000)	0	0	0	0
	Plus: Unobligated balance EOY	68,634	19,333	0	0	0
	Total Budget Authority	<u>304,179</u>	<u>246,780</u>	<u>248,783</u>	<u>338,004</u>	<u>89,221</u>
	Transfer to the NIST Working Capital Fund	<u>0</u>	<u>0</u>	<u>0</u>	<u>1,600</u>	<u>1,600</u>
	Total Requirements	<u>304,179</u>	<u>246,780</u>	<u>248,783</u>	<u>339,604</u>	<u>90,821</u>

Personnel Data

Full-time equivalent employment:

Full-time permanent	323	356	356	388	32
Other than full-time permanent	37	37	37	37	0
Total	<u>360</u>	<u>393</u>	<u>393</u>	<u>425</u>	<u>32</u>

Authorized Positions:

Full-time permanent	364	366	366	410	44
Other than full-time permanent	13	13	13	13	0
Total	<u>377</u>	<u>379</u>	<u>379</u>	<u>423</u>	<u>44</u>

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
11 Personnel compensation				
11.1 Full-time permanent				
Executive level	0	0	0	0
Senior executive service	\$54	\$1,159	\$1,159	0
Career path	1,077	24,634	26,844	\$2,210
Wage board	0	0	0	0
Scientific & professional (P.L. 80-313)	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal	1,131	25,793	28,003	2,210
11.3 Other than full-time permanent				
Career path	30	1,705	1,705	0
Wage board	0	0	0	0
Scientific & professional (P.L. 80-313)	0	0	0	0
Experts & consultants	0	0	0	0
Student	<u>0</u>	<u>77</u>	<u>77</u>	<u>0</u>
Subtotal	30	1,782	1,782	0
11.5 Other personnel compensation				
Overtime	0	206	206	0
SES performance awards	0	25	25	0
Cash awards	0	352	352	0
Merit pay awards	0	0	0	0
Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal	0	583	583	0
11.9 Total personnel compensation	<u>1,161</u>	<u>28,158</u>	<u>30,368</u>	<u>2,210</u>

<u>Object Class</u>	2001 Adjustments to Base	2001 Base	2001 Estimate	Increase/ (Decrease) over 2001 Base
12.1 Civilian personnel benefits				
Civil service retirement	(54)	716	712	(4)
Federal employees' retirement	191	1,715	1,956	241
Thrift savings plan	36	617	663	46
Contribution to civil service retirement and disability fund	0	0	0	0
Federal Insurance Contribution Act	129	1,348	1,520	172
Health insurance	121	1,121	1,204	83
Life insurance	3	41	45	4
Employees' Compensation Fund	(17)	155	154	(1)
Other	<u>24</u>	<u>82</u>	<u>81</u>	<u>(1)</u>
Subtotal	433	5,795	6,335	540
13 Benefits for former personnel				
Severance pay	0	0	0	0
Unemployment compensation	0	11	11	0
Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal	0	11	11	0
21 Travel and transportation of persons				
Common carrier	24	591	831	240
Mileage	0	41	57	16
Per diem/actual	23	642	995	353
Other	<u>0</u>	<u>331</u>	<u>459</u>	<u>128</u>
Subtotal	47	1,606	2,342	736
22 Transportation of things	1	131	339	208
23.1 Rental payments to GSA	0	17	15	(2)
23.2 Rental payments to others	11	671	671	0

<u>Object Class</u>		<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
23.3	Communications, utilities, and miscellaneous charges				
	Rental of ADP equipment	0	8	77	69
	Rental of office copying equipment	0	46	140	94
	Other equipment rental	3	125	139	14
	Federal telecommunications system	3	109	126	17
	Other telecommunications services	3	263	376	113
	Postal Service by USPS	0	233	265	32
	Utilities:				
	Electric	25	1,213	1,422	209
	Gas	6	374	443	69
	Water/Sewer	<u>4</u>	<u>275</u>	<u>325</u>	<u>50</u>
	Subtotal	44	2,646	3,313	667
24	Printing and reproduction				
	Publications	6	204	341	137
	Other	<u>0</u>	<u>9</u>	<u>71</u>	<u>62</u>
	Subtotal	6	213	412	199
25.1	Advisory and assistance services				
	Management & professional support services	12	2,959	2,959	0
	Studies, analyses, & evaluation	<u>24</u>	<u>805</u>	<u>805</u>	<u>0</u>
	Subtotal	36	3,764	3,764	0
25.2	Other services				
	Training:				
	Other	40	366	730	364
	ADP Services	15	766	846	80
	Other non-government contracts	<u>95</u>	<u>8,568</u>	<u>13,738</u>	<u>5,170</u>
	Subtotal	150	9,700	15,314	5,614

<u>Object Class</u>		<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
25.3	Purchases of goods and services from Government accounts				
	Payments to GA, WCF	(97)	1,137	1,127	(10)
	Office of Personnel Management	0	15	15	0
	Other Federal agencies:		456	447	(9)
	Dept. of Commerce	75	332	1,844	1,512
	Other	<u>60</u>	<u>4,628</u>	<u>6,341</u>	<u>1,713</u>
	Subtotal	38	6,568	9,774	3,206
25.5	Research and development contracts	0	55	55	0
25.7	Operation and maintenance of equipment	11	261	387	126
26	Supplies and materials				
	Office & laboratory supplies	22	1,585	1,945	360
	Scientific publications & journals	3	368	365	(3)
	Fuel oil	<u>0</u>	<u>11</u>	<u>11</u>	<u>0</u>
	Subtotal	25	1,964	2,321	357
31	Equipment				
	Office machines and other equipment	3	200	320	120
	ADP equipment	7	519	782	263
	Equipment amortization	<u>30</u>	<u>2,211</u>	<u>2,209</u>	<u>(2)</u>
	Subtotal	40	2,930	3,311	381
32	Land and structures	0	66	66	0
41	Grants, subsidies and contributions	0	207,357	282,336	74,979
42	Insurance claims and indemnities	0	3	3	0
99	Total Obligations	<u>2,003</u>	<u>271,916</u>	<u>361,137</u>	<u>89,221</u>
	Prior Year Recoveries	0	(3,800)	(3,800)	0
	Unobligated Balance SOY	<u>0</u>	<u>(19,333)</u>	<u>(19,333)</u>	<u>0</u>
	Total Budget Authority	2,003	248,783	338,004	89,221
	Transfer to NIST Working Capital Fund	0	0	1,600	1,600
	Total Requirements	<u>2,003</u>	<u>248,783</u>	<u>339,604</u>	<u>90,821</u>

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
ACTIVITY/SUBACTIVITY CHANGE CROSSWALK - PART 1 (2000 STRUCTURE)
(Dollar amounts in thousands)

<u>Activity/Subactivity</u>	<u>2001 Direct Obligations</u>	<u>Proposed Changes</u>
<u>Extramural Programs</u>		
Institute for Information Infrastructure Protection	\$48,400	Add this new subactivity to Extramural Programs

Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Industrial Technology Services
 ACTIVITY/SUBACTIVITY CHANGE CROSSWALK - PART 2 (2001 STRUCTURE)
 (Dollar amounts in thousands)

<u>Activity/Subactivity</u>	1997	1998	1999	2000	2001
<u>Extramural Programs</u>					
Advanced Technology Program	\$252,785	\$179,092	\$190,343	\$211,000	\$198,600
Manufacturing Extension Partnership	98,136	114,136	127,901	105,081	114,137
Institute for Information Infrastructure Protection	0	0	0	0	48,400
TOTALS	350,921	293,228	318,244	316,081	361,137

Department of Commerce
Technology Administration
National Institute of Standards and Technology

Industrial Technology Services
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For necessary expenses of the Manufacturing Extension Partnership of the National Institute of Standards and Technology,

15 U.S.C. 278k, 278l

15 U.S.C. 278k directs the Secretary, through the Director of NIST, to provide assistance for the creation of Regional Centers for the Transfer of Manufacturing Technology.

15 U.S.C. 278l directs the Secretary, through the Director of NIST or other appropriate officials, to provide technical assistance to State technology programs.

2. \$114,137,000, to remain available until expended,

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states: "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provision."

3. Section 15 U.S.C. 278k(c) (5) as amended by 15 U.S.C. 217 note the duration of Federal financial assistance that may be awarded by the Secretary of Commerce to Regional Centers for the transfer of Manufacturing Technology Centers, states "After the sixth year, a center may receive additional financial support under this section if it has received a position evaluation through an independent review, under procedures established by the Institute. Such an independent review shall be required at least every two years after the sixth year of operation shall not exceed one third of the capital and annual operating and maintenance costs of the Center under program." The Secretary of Commerce determines that "continuation of Federal funding to the Center is in the best

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interest of the Regional Centers for the transfer of Manufacturing Technology,” and “that the Center’s most recent performance evaluation is positive, and the center has submitted a reapplication which has successfully passed merit review.”

4. In addition, for necessary expenses of the Advanced Technology Program of the National Institute of Standards and Technology,

15 U.S.C. 278n

15 U.S.C. 278n establishes in the Institute (NIST) an Advanced Technology Program.

5. \$175,467,000, to remain available until expended,

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states: "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provision."

Additional authorizing legislation will be proposed for FY 2001.

6. In addition, for necessary expenses of the Institute for Information Infrastructure Protection of the National Institute of Standards and Technology, \$50,000,000, to remain available until expended of which not to exceed \$1,600,000 may be transferred to the Working Capital Fund.

15 U.S.C. 278b

15 U.S.C. 278b provides in part: “the National Institute of Standards and Technology is authorized to utilize in the performance of its functions the Working Capital Fund...”

Additional authorizing legislation will be proposed for FY 2001.

Department of Commerce
National Institute of Standards and Technology
Industrial Technology Services
SCHEDULE OF ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY2001 <u>Estimate</u>
Management and professional support services	\$2,952	\$2,947	\$2,959
Studies, analyses, and evaluations	<u>769</u>	<u>781</u>	<u>805</u>
Total	3,721	3,728	3,764

Significant Activities

ITS advisory and assistance services are concerned with a review and evaluation of grants associated with the Advanced Technology Program (ATP) and the Manufacturing Extension Program (MEP) and with evaluation of their programmatic outcomes, service delivery efficiency, and internal infrastructure requirements.

Need for Advisory and Assistance Services:

The need for advisory and assistance services stems from the NIST role in dealing with the private sector, professional organizations, and the public sector. Inputs must be obtained from consultants who can bring their individual expertise to bear and help NIST in implementing its program plans to meet the needs of its customers. The alternative to utilizing these services is to make no attempt to have expertise from sources outside NIST and risk having a poorer working and professional relationship with those in the business of using the products and services offered by NIST.

Internal Controls to Ensure Appropriate Use:

Requisition requests from NIST program managers for advisory and assistance services must be accompanied by written justification for the need for such services. Personal services contracts require review by the Office of Human Resources Management.

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

Page No.			<u>Positions</u>		<u>FTE</u>	<u>Budget Authority</u>		<u>Direct Obligations</u>		<u>Appro- Appropriation</u>		
	Currently Available, 2000		32		33		\$106,880		\$226,386		\$106,880	
	less: Unobligated balance from prior years		0		0		0		(119,506)		0	
NIST-253	plus: 2001 Adjustments to base		<u>0</u>		<u>0</u>		<u>(75,483)</u>		<u>(75,483)</u>		<u>(75,483)</u>	
	2001 Base Request		32		33		31,397		31,397		31,397	
	plus: 2001 Program changes		<u>0</u>		<u>0</u>		<u>4,482</u>		<u>4,482</u>		<u>4,482</u>	
	2001 Estimate		32		33		35,879		35,879		35,879	
			1999		2000		2001		2001		Increase/ (Decrease)	
			<u>Actual</u>		<u>Currently Available</u>		<u>Base</u>		<u>Estimate</u>		<u>Over 2001 Base</u>	
<u>Comparison by activity:</u>			<u>Per-</u>		<u>Per-</u>		<u>Per-</u>		<u>Per-</u>		<u>Per-</u>	
			<u>sonnel</u>	<u>Amount</u>	<u>sonnel</u>	<u>Amount</u>	<u>sonnel</u>	<u>Amount</u>	<u>sonnel</u>	<u>Amount</u>	<u>sonnel</u>	<u>Amount</u>
Construction and major renovations												
NIST-259	Construction and major	Pos/Approp	32	\$56,714	32	\$106,880	32	\$31,397	32	\$35,879	0	\$4,482
	renovations	FTE/Obl.	27	19,603	33	226,386	33	31,397	33	35,879	0	4,482
Adjustments to obligations:												
	Prior year recoveries			(99)								
	Unobligated balance, start of year			(82,296)		(119,506)						
	Unobligated balance, end of year			119,506								
Financing from transfers:												
	Transfer to other accounts (+)			<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>		<u>0</u>
Appropriation				56,714		106,880		31,397		35,879		4,482

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

	<u>Perm Pos</u>	<u>FTE</u>	<u>Amount</u>
<u>Adjustments:</u>			
Non-recurring:			
Advanced Measurement Laboratory.....	(\$69,916)
FY 2000 Grants and cooperative agreements.....			(11,700)
Safety, capacity, maintenance, and major repairs.....	5,000
<u>Other Changes:</u>			
2000 Pay raise (annualization).....	21
2001 Pay raise.....	64
Within-grade step increases.....	22
One less compensable day.....	(8)
Personal Benefits:			
Civil Service Retirement System (CSRS).....	(7)
Federal Employees' Retirement System (FERS).....	8
Thrift Savings Plan (TSP).....	2
Federal Insurance Contribution Act (FICA).....	5
Health Insurance.....	5
Communications, utilities, and miscellaneous charges.....	1
Other services.....	111
Supplies and materials.....	27
Equipment.....	4
Total, Adjustments to Base.....	(76,361)

Department of Commerce
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF ADJUSTMENTS TO BASE
(Dollar amounts in thousands)

FTE Amount

Adjustments:

Advanced Measurement Laboratory..... 0 (\$69,916)

In accordance with the approved plan for the construction of the Advanced Measurement Laboratory (AML), a reduction of \$69,916,000 will leave \$15,000,000 in FY 2001 for fit-up, relocation, and communication costs.

Grants and Cooperative Agreements 0 (10,822)

In FY 2000, Congress added funding for grants and cooperative agreements earmarked for the Medical University of South Carolina (\$8,325,000) the Institute at St. Anselm College (\$1,850,000), and the New Hampshire State Library (\$647,500). This adjustment reflects elimination of this funding in FY 2001.

Safety, Capacity, Maintenance, and Major Repairs 0 5,000

In accordance with the approved plan, this adjustment reverses the one-time decrease of \$5,000,000 in the FY 2000 Congressional budget that partially offset the cost of the AML construction and restores the Modifications and Improvements base.

Other Changes:

2000 Pay raise (annualization) 0 21

A pay raise of 4.8 percent was effective January 1, 2000.

Total cost in FY 2001 of 2000 pay raise	\$84,000
Less amount requested in FY 2000	(63,000)
Less amount absorbed in FY 2000	<u>0</u>
Amount requested in 2001 to provide full-year cost of 2000 pay raise	21,000
Payment to Working Capital Fund.....	<u>0</u>
Total, FY 2000 pay raise increase in FY 2001	21,000

2001 Pay increase and related costs 0 64

A general pay raise of 3.7 percent is assumed to be effective January 1, 2001.

Total cost in FY 2001 of pay increase.....	\$64,000
Less amount absorbed in FY 2001	<u>0</u>
Amount requested for FY 2001 pay increase	64,000
Payment to Working Capital Fund.....	<u>0</u>
Total adjustment for FY 2001 pay increase	64,000

Within-grade step increases 0 22

An increase of \$22,000 is required to cover the cost of within-grade step increases.

One less compensable day..... 0 (8)

The decreased cost of one less compensable day in FY 2001 compared to FY 2000 is calculated by dividing the FY 2000 estimated personnel compensation and applicable benefits by 261 compensable days.

Personnel benefits.....	0	13
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Civil Service Retirement System (CSRS).....	(7)
Federal Employees' Retirement System (FERS).....	8
Thrift Savings Plan (TSP)	2
Federal Insurance Contribution Act (FICA) - OASDI	5
Health Insurance.....	5

Civil Service Retirement System (-\$7,000) - The number of employees covered by the Civil Service Retirement System (CSRS) continues to drop as positions become vacant and are filled by employees who are covered by the Federal Employees' Retirement System (FERS). The estimated percentage of payroll for employees covered by CSRS will drop from 39.2 percent in FY 2000 to 35.1 percent in FY 2001. Contribution rates will remain the same.

Payroll subject to retirement systems (\$1,912,500)	
Cost of CSRS contributions in FY 2001 ($\$1,912,500 \times .351 \times .0851$)	\$57,127
Cost of CSRS contributions in FY 2000 ($\$1,912,500 \times .392 \times .0851$)	<u>63,799</u>
Total adjustment-to-base	(6,672)

Federal Employees' Retirement System (\$8,000) - The number of employees covered by FERS continues to rise as employees covered by CSRS leave and are replaced by employees covered by FERS. The estimated percentage of payroll for employees covered by FERS will rise from 60.8 percent in FY 2000 to 64.9 percent in FY 2001. The contribution rate will remain at 10.7 percent in FY 2001.

Payroll subject to retirement systems (\$1,912,500)	
Basic benefit cost in FY 2001 ($\$1,912,500 \times .649 \times .107$).....	\$132,810
Basic benefit cost in FY 2000 ($\$1,912,500 \times .608 \times .107$).....	<u>124,420</u>
Total adjustment-to-base	8,390

Thrift Savings Plan (\$2,000) - The cost of agency contributions to the Thrift Savings Plan will also rise as FERS participation increases. The contribution rate is expected to remain 2 percent.

Thrift plan cost in FY 2001 ($\$1,912,500 \times .649 \times .02$)	\$24,824
Thrift plan cost in FY 2000 ($\$1,912,500 \times .608 \times .02$)	<u>23,256</u>
Total adjustment-to-base	1,568

Federal Insurance Contributions Act (FICA) - OASDI (\$5,000) - As the percentage of payroll covered by FERS rises, the cost of OASDI contributions will increase. In addition, the maximum salary subject to OASDI tax will rise from \$73,275 in FY 2000 to \$78,450 in FY 2001. The OASDI tax rate will remain 6.2 percent in FY 2001.

FERS payroll subject to FICA tax in 2001 (\$1,912,500 x .649 x .932 x .062).....	\$71,722
FERS payroll subject to FICA tax in 2000 (\$1,912,500 x .608 x .925 x .062).....	<u>66,687</u>
Increase (FY 2000-FY 2001).....	5,035
OTP payroll subject to FICA tax in FY 2001 (\$51,500 x .649 x .932 x .062).....	\$1,931
OTP payroll subject to FICA tax in FY 2000 (\$51,500 x .608 x .925 x .062).....	<u>1,796</u>
Change (FY 2000-FY 2001).....	135
Total adjustment-to-base	5,170

Health insurance (\$5,000) - Effective January 1999, NIST's contribution to Federal employees' health insurance premiums increased by 12.3 percent. This percentage was applied against the FY 2000 estimate.

Communications, utilities, and miscellaneous charges 0 1

This adjustment to base is required to pay the additional cost of communications and miscellaneous charges. The increased costs are based on applying the 1.5 percent deflator to the FY 2000 estimate for rental of ADP equipment, office equipment, and other equipment.

Other services 0 111

NIST is requesting \$111,000 to cover increased costs in other services. For Construction of Research Facilities, other services include non-governmental contracts, training, and maintenance of equipment. The increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate for other services.

Supplies and materials 0 27

The \$27,000 increase was calculated by applying the deflator of 1.5 percent to the FY 2000 estimate for supplies and materials.

Equipment.....	0	4
Office-ADP-Other equipment (\$4,000) - The \$4,000 increase was calculated by applying the 1.5 percent deflator to the FY 2000 estimate for office machines, ADP, and other equipment.		
Total, Adjustments to Base	0	(75,483)

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Construction and major renovations
Subactivity: Construction and major renovations

<u>Line Item</u>		1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) over 2001 Base	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Construction and major renovations	Pos/Approp	12	\$40,000	12	\$95,738	12	\$15,000	12	\$15,500	0	\$500
	FTE/Obl.	10	2,258	12	214,952	12	15,000	12	15,500	0	500
Modifications and improvements	Pos/Approp	20	16,714	20	\$11,142	20	\$16,397	20	\$20,379	0	3,982
	FTE/Obl.	17	17,345	21	11,434	21	16,397	21	20,379	0	3,982
Totals	Pos/Approp	32	56,714	32	106,880	32	31,397	32	35,879	0	4,482
	FTE/Obl.	27	19,603	33	226,386	33	31,397	33	35,879	0	4,482

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
JUSTIFICATION OF PROGRAM AND PERFORMANCE
CONSTRUCTION AND MAJOR RENOVATIONS

Goal Statement

This program supports all NIST activities by providing the staff with the facilities to support the DoC strategic goals to stimulate innovation for competitiveness.

Base Program

The base program includes funding for construction and repair of NIST facilities to meet the metrology and research needs of the 21st Century. NIST started initial construction in FY 2000 of an Advanced Measurement Laboratory (AML) in Gaithersburg, Maryland. The Laboratory will provide stringent controls for particulate matter, temperature, vibration, and humidity that are unattainable in current NIST buildings, and equal or better than similar national standards and measurements laboratories overseas. Such conditions are vital for housing NIST's most advanced metrology, physics, chemistry, electronics, engineering and materials science research projects. These programs must keep pace with rapid developments in semiconductors, precision instruments, industrial robots, computers, chemicals, pharmaceuticals, building materials, and emerging technologies requiring molecular and atomic-level precision.

The total AML project cost of \$218.2 million is based on construction over five years from existing designs, which were updated to take advantage of the most recent developments in building design. In FY 1999, \$118.3 million was carried over and combined with the \$84.9 million that was provided in FY 2000, for a total of \$203.2 million, which was used to start the construction of the AML. An additional \$15 million will be needed in FY 2001 for fitup and relocation.

The remaining \$16.4 million in base under this subactivity is used to address the highest priority safety, capacity, maintenance and major repair projects at NIST. This will ensure compliance with various health and safety regulations, improve access for the handicapped, perform repairs and minor renovations as well as safeguard the utility infrastructure of existing buildings.

The FY 2001 base program operating objectives include the following:

- Continue construction of the AML.
- Continue abatement of hazardous materials from NIST sites and buildings.
- Continue to modify the sites to comply with the Access to Federal Buildings Act and the Americans with Disabilities Act.
- Continuous repairs/replacements of the following sitewide systems: Utility Systems, Exhaust and Air Filtration Systems, Mechanical-electrical Systems, and Site Alarm and Fire Safety Systems.
- Continuous architectural, structural, and conservation repairs as needed.

Although a plan is developed for the use of the base funds, it is important to note that the planned use of funds is subject to change if and when facilities-related emergency situations arise. Also, in many cases, final cost estimates resulting from contract negotiations may affect the number of projects that can be funded.

Performance Measures

The focus of this program is to keep the laboratory and office space safe and as conducive to scientific work as possible within the funding available. The following measures will track how well NIST achieves this goal.

- Keep AML construction on schedule and within budget by not exceeding 110 percent of estimates.
- For existing NIST buildings, keep the operating time lost due to unscheduled downtime to less than 10 percent of total scheduled possible operating time, on average.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
INCREASE FOR FY 2001
(Dollar amounts in thousands)

	<u>2001 Base</u>		<u>2001 Estimate</u>		<u>Increase/(Decrease) Over 2001 Base</u>	
	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Construction and major renovations Pos./Approp	12	\$15,000	12	\$15,500	0	\$500
FTE/Obl.	12	15,000	12	15,500	0	500

Facilities technical obsolescence (BA +\$500,000, Direct Obligations +\$500,000) - To begin the first step to complete several urgently needed construction and major renovation projects on NIST's Boulder, Colorado, campus. The first project, which is included in this request is the design for a new primary electrical service. This program supports the DoC Secretarial priority on Addressing Critical Construction Needs.

Problem Magnitude and NIST Role:

The majority of the current 45-year old NIST laboratory facilities in Boulder, Colorado, are failing to adequately support the Institute's mission of providing U.S. industry and science with the best possible measurement system. If technical program needs continue to escalate and the buildings continue to deteriorate at the current pace, more than 80 percent of NIST's laboratory facilities will fail to adequately support the current needs of U.S. industry and science. Annual transactions involving more than \$4 trillion in U.S. products depend upon NIST's maintenance of accurate weights and measures.

The current plan for NIST's Construction of Research Facilities program is the culmination of a long and thorough effort to ensure that NIST keeps pace with advances in science and technology and the requirements of the Nation for advanced technical measurements and standards. NIST's proposed five-year plan for fiscal years 2001 through 2005 is drawn from a 17-year master schedule of needed facilities improvements. NIST's revised five-year plan addresses only its most urgent, highest priority facilities needs that must be addressed to allow

NIST to continue to fulfill its mission. The plan assumes no growth in NIST staffing levels. A thorough technical needs assessment by Smith, Hinchman, & Grylls Associates (SH&G) Incorporated reported that "... Continued neglect of NIST's facilities has dramatically affected the ability of laboratory and technical space users to conduct measurement research." Booz-Allen & Hamilton concludes "without intervention, the performance deterioration caused by the facilities inadequacies will impede, if not invalidate, NIST's ability to maintain standards in weights and measures, and to facilitate the development and application of new technology."

Inadequacies of Boulder Facilities:

Facilities on NIST's Boulder campus are about 10 years older, on average, than those in Gaithersburg. Most of Boulder's buildings were constructed in the early to mid 1950's.

Two of the many ways in which NIST's inadequate facilities at Boulder adversely affect U.S. industry and science today are:

- The research group responsible for submitting the data that is then combined with data from around the world to determine Universal Coordinated Time (UTC) is being severely hampered by the lack of environmental building controls. Severe temperature fluctuations and electrical power interruptions often threaten the quality of the NIST data. The group must spend substantial time and effort to overcome environmental problems, limiting their ability to conduct research to develop improved time scales.
- Power outages, spikes, brownouts, and other power problems have been damaging sensitive equipment. Just one of the more than twenty research groups estimates that it spends \$20,000 to \$30,000 a year to replace equipment damaged by power problems.

Proposed NIST Technical Program:

New Primary Electrical Service - The NIST Boulder campus experiences frequent power outages and power spikes due to the remaining overhead power lines that remain at the site. The power outages are due to factors such as high winds, small animals, and lightning, which can produce line breakages or shorts. These power outages and spikes are extremely disruptive to Boulder laboratory research. Loss of power, even for a few seconds, can cause some research projects requiring long data collection times to have to be done completely over. Voltage drops can cause delicate microscope probes to crash into expensive samples or produce inaccurate measurement readings lowering the quality of data.

NIST plans to alleviate a large portion of its problems with inadequate power supplies by constructing a conduit for a new set of power cables from the National Center for Atmospheric Research power substation, which is slightly less than 2 miles away. An October 1998,

review by HDR Associates Inc.¹ found that design and construction of this new primary electrical service would cost \$6 million in FY 2001 dollars. This request of \$500 thousand is for the design work for such a service. An additional \$5.5 million will be needed in FY 2002 to complete the project.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Facilities Technical Obsolescence Initiative	
Technical Area	Output
Facilities technical obsolescence	<ul style="list-style-type: none">• Keep design on schedule and within budget by not exceeding 110 percent of estimates

Performance Measures: Outcomes

The beneficial impact of upgrading the Boulder facilities will be long-term and significant. NIST researchers seek to measure reliably everything from length, to time, to mass, to electric current – before industry or science hits a roadblock in its pursuit of a better product or new understanding of the way the world works. In this way, NIST research helps foster technological innovation, the driving force for about 50 percent of U.S. economic growth. NIST must be the best at measuring a whole range of quantities because industry needs high accuracy. NIST’s job is to provide U.S. manufacturers and scientists with “gold standard” templates that are indispensable to enable new generations of science, technology, and competitive products.

Although the construction on the Boulder site will have some disruptive effect on the other laboratories, NIST anticipates that the scientists will continue to make the necessary adjustments required to meet their programmatic goals.

¹ HDR Inc., *NIST Central Utility Plant Facility and Site Utility Distribution System*, 49 pgs., Oct. 1998

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Construction and major renovations
Subactivity: Construction and major renovations
Program Change: Facilities technical obsolescence

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$0
11.9 Total personnel compensation	0
12.1 Civilian personnel benefits	0
21 Travel and transportation of persons	0
22 Transportation of things	0
23.3 Communications, utilities and miscellaneous charges	0
24 Printing and reproduction	0
25.1 Advisory and assistance services	0
25.2 Other services	500
25.3 Purchases of goods and services from Government accounts	0
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	0
26 Supplies and materials	0
31 Equipment	0
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 500
Transfer to NIST Working Capital Fund	0
Total increase requested	<hr/> 500

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
INCREASE FOR FY 2001
(Dollar amounts in thousands)

	2001 Base		2001 Estimate		Increase/(Decrease) Over 2001 Base	
	Personnel	Amount	Personnel	Amount	Personnel	Amount
Modifications and improvements..... Pos./Approp	20	\$16,397	20	\$20,379	0	\$3,982
FTE/Obl.	21	16,397	21	20,379	0	3,982

Safety, capacity, maintenance, and major repairs (BA +\$3,982,000, Direct Obligations +\$3,982,000) - This proposal is the first step to address NIST's plan to ramp the safety capacity, maintenance, and major repairs base up to an approximate annual level of \$60 million. This program supports the DoC Secretarial priority on Addressing Critical Construction Needs.

Problem Magnitude and NIST Role:

A combination of aging, inadequate system capacity, tightening regulations at the Federal, state and local levels, and more stringent science and engineering program requirements have taxed NIST's major facilities and building systems to a point where replacement or extensive upgrade is imperative. Resources in this program are utilized at both the Gaithersburg Maryland, and Boulder, Colorado sites. Planned projects include a wide range of projects such as continued upgrades to fire safety systems, removal of hazardous asbestos materials, replacement of compressors or antiquated control systems and electrical switchgear, replacement and repair of selected roofs and roads, and improved accessibility for the handicapped. Many of these projects have been deferred in previous years to the point where they present risks for safety, critical failures, or non-compliance with building codes.

At the request of both the Administration and the Congress, NIST re-evaluated its facilities requirements. A contract was awarded to SH&G, Incorporated to update NIST's facilities needs requirements. Their draft report states that "the pervasive deterioration has created a significant backlog of safety and capacity replacement and repair needs... NIST has spent the majority of the available funding on safety and capacity upgrades to alleviate hazardous conditions and failing building systems components, however this effort falls far short of the

facility needs.” Another analysis was done by Booz-Allen and Hamilton verifies NIST’s need for increased funding in safety, capacity, maintenance, and major repairs. They recommend a yearly funding level of \$48 million plus an additional \$18.7 million towards a buy down of the \$400 million backlog, for a total of \$66.7 million. Since this study was completed, the backlog has grown to about \$790 million. Although NIST is not requesting this level of funding, its intent is to gradually increase the funding up to a level that is both effective, manageable, and can keep close pace in the facilities repair needs of the two NIST sites.

Proposed NIST Technical Program

Resources in this program are utilized in Gaithersburg, Maryland, and Boulder, Colorado, for assured compliance with various Federal, state, and local health and safety regulations, for modifications to improve access for people with disabilities, and to keep NIST’s current buildings in good working order.

Performance Measures: Outputs

At the proposed funding level, NIST will generate the following outputs:

Safety, Capacity, Maintenance, and Major Repairs Initiative	
Technical Area	Output
Safety, Capacity, Maintenance, and Major Repairs	<ul style="list-style-type: none">• For existing NIST buildings, keep the operating time lost due to unscheduled downtime to less than 10 percent of total scheduled possible operating time, on average

Performance Measures: Outcomes

The beneficial impact of maintaining NIST’s facilities on the U.S. economy will be long-term and significant. NIST researchers seek to measure reliably everything from length, to time, to mass, to electric current – before industry or science hits a roadblock in its pursuit of a better product or new understanding of the way the world works. In this way, NIST research helps foster technological innovation, the driving force for about 50 percent of U.S. economic growth. NIST must be the best at measuring a whole range of quantities because industry needs high accuracy. NIST’s job is to provide U.S. manufacturers and scientists with “gold standard” templates that are indispensable to enable new generations of science, technology, and competitive products.

The aggregate effect of NIST facilities' inefficiencies on the U.S. economy is large. According to several economic impact studies conducted for NIST, the benefit-cost ratio for specific NIST research programs has ranged from 3 to 1 to more than 100 to 1. In other words, for every dollar spent on NIST research in the studied areas, benefits of \$3 to more than \$100 were realized by the economy. However, NIST researchers are being forced to devote more and more of their time to controlling experimental environments rather than conducting actual measurement research and passing their results on to industry and science.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
PROGRAM CHANGE DETAIL BY OBJECT CLASS
(Dollars in thousands)

Activity: Construction and major renovations

Subactivity: Construction and major renovations

Program Change: Safety, capacity, maintenance, and major repairs

<u>Object Class</u>	2001 Increase/ (Decrease) <u>Obligations</u>
11 Personnel compensation	
11.1 Full-time permanent	\$0
11.9 Total personnel compensation	0
12.1 Civilian personnel benefits	0
21 Travel and transportation of persons	0
22 Transportation of things	0
23.3 Communications, utilities and miscellaneous charges	0
24 Printing and reproduction	0
25.1 Advisory and assistance services	0
25.2 Other services	3,982
25.3 Purchases of goods and services from Government accounts	0
25.5 Research and development contracts	0
25.7 Operation and maintenance of equipment	0
26 Supplies and materials	0
31 Equipment	0
32 Land and structures	0
41 Grants, subsidies and contributions	0
99 Direct obligations	<hr/> 3,982
Transfer to NIST Working Capital Fund	0
Total increase requested	<hr/> 3,982

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>1999 Actual</u>	<u>2000 Currently Available</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) Over 2001 Base</u>
11 Personnel compensation					
11.1 Full-time permanent	\$1,179	\$1,455	\$1,539	\$1,539	0
11.3 Other than full-time permanent	98	95	99	99	0
11.5 Other personnel compensation	0	0	0	0	0
11.9 Total personnel compensation	1,277	1,550	1,638	1,638	0
12.1 Civilian personnel benefits	272	341	365	365	0
13 Benefits for former personnel	0	0	0	0	0
21 Travel and transportation of persons	13	13	13	13	0
22 Transportation of things	10	9	9	9	0
23.2 Rental payments to others	0	0	0	0	0
23.3 Communications,utilities, and miscellaneous charges	27	5	6	6	0
24 Printing and reproduction	1	1	2	2	0
25.1 Advisory and assistance services	0	0	0	0	0
25.2 Other services	11,401	6,001	10,788	15,270	\$4,482
25.3 Purchases of goods and services from Gov. accounts	0	0	0	0	0
25.7 Operation and maintenance of equipment	370	354	385	385	0
26 Supplies and materials	1,004	947	974	974	0
31 Equipment	693	651	655	655	0
32 Land and structures	4,535	205,692	16,562	16,562	0
41 Grants, subsidies and contributions	0	10,822	0	0	0
42 Insurance claims and indemnities	0	0	0	0	0
99 Total obligations	19,603	226,386	31,397	35,879	4,482

<u>Object Class</u>		<u>1999 Actual</u>	<u>2000 Currently Available</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) Over 2001 Base</u>
99	Total obligations	19,603	226,386	31,397	35,879	4,482
	Less: Prior year recoveries	(99)				
	Less: Prior year unobligated balance	(82,296)	(119,506)			
	Plus: Unobligated balance, end of year	<u>119,506</u>				
	Total Requirements	56,714	106,880	31,397	35,879	4,482

Personnel Data

Full-time equivalent employment:

Full-time permanent	25	31	31	31	0
Other than full-time permanent	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>0</u>
Total	27	33	33	33	0

Authorized Positions:

Full-time permanent	30	30	30	30	0
Other than full-time permanent	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>0</u>
Total	32	32	32	32	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Construction of Research Facilities
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

		2001 Adjustments to Base	2001 Base	2001 Estimate	Increase/ (Decrease) over 2001 Base
	<u>Object Class</u>				
11	Personnel compensation				
11.1	Full-time permanent				
	Executive level				
	Senior executive service				
	Career path	\$57	\$1,007	\$1,007	\$0
	Wage board	27	532	532	0
	Scientific & professional (P.L. 80-313)	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	84	1,539	1,539	0
11.3	Other than full-time permanent				
	Career path	4	97	97	0
	Wage board	0	2	2	0
	Scientific & professional (P.L. 80-313)	0	0	0	0
	Experts & consultants	0	0	0	0
	Student	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	4	99	99	0
11.5	Other personnel compensation				
	Overtime	0	0	0	0
	SES performance awards	0	0	0	0
	Cash awards	0	0	0	0
	Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	0	0	0	0
11.9	Total personnel compensation	<u>88</u>	<u>1,638</u>	<u>1,638</u>	<u>0</u>

<u>Object Class</u>		<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
12.1	Civilian personnel benefits				
	Civil service retirement	(6)	44	44	0
	Federal employees' retirement	13	114	114	0
	Thrift savings plan	3	42	42	0
	Federal Insurance Contribution Act	9	91	91	0
	Health insurance	5	71	71	0
	Life insurance	0	2	2	0
	Employees' Compensation Fund	0	0	0	0
	Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	24	365	365	0
13	Benefits for former personnel				
	Severance pay	0	0	0	0
	Unemployment compensation	0	0	0	0
	Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	0	0	0	0
21	Travel and transportation of persons				
	Common carrier	0	3	3	0
	Mileage	0	0	0	0
	Per diem/actual	0	8	8	0
	Other	<u>0</u>	<u>2</u>	<u>2</u>	<u>0</u>
	Subtotal	0	13	13	0
22	Transportation of things	0	9	9	0
23.2	Rental payments to others	0	0	0	0

<u>Object Class</u>		<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
23.3	Communications, utilities, and miscellaneous				
	Rental of ADP equipment	0	0	0	0
	Rental of office copying equipment	0	0	0	0
	Other equipment rental	0	5	5	0
	Federal telecommunications system	0	0	0	0
	Other telecommunications services	1	1	1	0
	Postal Service by USPS	0	0	0	0
	Utilities:				0
	Electric	0	0	0	0
	Gas	0	0	0	0
	Water/Sewer	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	1	6	6	0
24	Printing and reproduction				
	Publications	1	2	2	0
	Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	1	2	2	0
25.1	Advisory and assistance services				
	Management and professional support services	0	0	0	0
	Studies, analyses, & evaluation	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	0	0	0	0
25.2	Other services				
	Training	0	32	32	0
	Maintenance of equipment	0	0	0	0
	ADP Services	7	400	400	0
	Other non-government contracts	<u>5,072</u>	<u>10,357</u>	<u>14,839</u>	<u>4,482</u>
	Subtotal	5,079	10,788	15,270	4,482

<u>Object Class</u>		<u>2001 Adjustments to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) over 2001 Base</u>
25.3	Purchases of goods and services from Government accounts				
	Payments to GA, WCF	0	0	0	0
	OPM training	0	0	0	0
	Other Federal agencies:	0	0	0	0
	Department of Commerce	0	0	0	0
	Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	0	0	0	0
25.7	Operation and maintenance of equipment	31	385	385	0
26	Supplies and materials				
	Office & laboratory supplies	27	974	974	0
	Scientific publications & journals	0	0	0	0
	Fuel oil	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	27	974	974	0
31	Equipment				
	Office machines and other equipment	0	428	428	0
	ADP equipment	4	226	226	0
	Equipment amortization	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>
	Subtotal	4	655	655	0
32	Land and structures	(69,916)	16,562	16,562	0
41	Grants, subsidies and contributions	(10,822)	0	0	0
42	Insurance claims and indemnities	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
99	Total Obligations	(75,483)	31,397	35,879	4,482
	Less: Prior year unobligated balance	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Total Budget Authority	(75,483)	31,397	35,879	4,482

Department of Commerce
National Institute of Standards and Technology

Construction of Research Facilities
APPROPRIATION LANGUAGE AND CODE CITATIONS

1. For construction of new research facilities, including architectural and engineering design, and for renovation of existing facilities, not otherwise provided for the National Institute of Standards and Technology as authorized by 15 U.S.C. 278c-278e,

15 U.S.C. 278c provides that "... the Secretary of Commerce is authorized to acquire land for such field sites as are necessary for the proper and efficient conduct of the activities authorized herein."

15 U.S.C. 278d provides "... the Secretary of Commerce is authorized to undertake such construction of buildings and other facilities... as are necessary for the proper and efficient conduct of the activities authorized herein."

15 U.S.C. 278e provides that "... in the performance of the functions of the National Institute of Standards and Technology the Secretary of Commerce is authorized to undertake the following activities: ... (b) the care, maintenance, protection, repair, and alteration of Institute buildings and other plant facilities, equipment, and property; ..."

2. \$35,879,000, to remain available until expended.

no specific authority

31 U.S.C. 718 - Appropriations in annual Appropriation Acts not permanent, states "No specific or indefinite appropriations... shall be construed to be permanent or available continuously... unless it is made in terms expressly providing that it shall continue available beyond the fiscal year for which the Appropriations Act in which it is contained makes provision."

3. Additional authorizing legislation will be proposed for FY 2001.

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Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Working Capital Fund
 SUMMARY OF REIMBURSABLE OBLIGATIONS
 (Dollar amounts in thousands)

	<u>Positions</u>	<u>FTE</u>	<u>Budget Authority</u>	<u>Direct Obligations</u>
2000 Currently Available	706	722	0	0
2001 Base	706	722	0	0
less: FTE transfer to STRS Program Changes	(11)	(8)	0	0
plus: Working Capital Fund transfer from STRS and ITS Program Changes	<u>0</u>	<u>0</u>	<u>\$7,800</u>	<u>\$7,800</u>
2001 Estimate	695	714	7,800	7,800

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REIMBURSABLE OBLIGATIONS
(Dollar amounts in thousands)

Page No.	Comparison by activity:	1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
		FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
	Measurement and engineering research and standards										
NIST- 38	Electronics and electrical engineering										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>100</u>	<u>\$14,639</u>	<u>99</u>	<u>\$13,350</u>	<u>99</u>	<u>\$13,350</u>	<u>98</u>	<u>\$13,350</u>	<u>(1)</u>	<u>0</u>
	Subtotal	100	14,639	99	13,350	99	13,350	98	13,350	(1)	0
NIST- 46	Manufacturing engineering										
	Direct obligations		0		0		0		250		\$250
	Reimbursable FTE/Obl	<u>50</u>	<u>6,182</u>	<u>51</u>	<u>6,034</u>	<u>51</u>	<u>5,938</u>	<u>51</u>	<u>5,938</u>	<u>0</u>	<u>0</u>
	Subtotal	50	6,182	51	6,034	51	5,938	51	6,188	0	250
NIST- 62	Chemical science and technology										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>116</u>	<u>14,782</u>	<u>117</u>	<u>15,197</u>	<u>117</u>	<u>15,664</u>	<u>117</u>	<u>15,664</u>	<u>0</u>	<u>0</u>
	Subtotal	116	14,782	117	15,197	117	15,664	117	15,664	0	0
NIST- 70	Physics										
	Direct obligations		0		0		0		1,800		1,800
	Reimbursable FTE/Obl	<u>67</u>	<u>13,401</u>	<u>68</u>	<u>13,468</u>	<u>68</u>	<u>13,551</u>	<u>68</u>	<u>13,551</u>	<u>0</u>	<u>0</u>
	Subtotal	67	13,401	68	13,468	68	13,551	68	15,351	0	1,800
NIST- 90	Materials science and engineering										
	Direct obligations		0		0		0		1,500		1,500
	Reimbursable FTE/Obl	<u>42</u>	<u>6,755</u>	<u>43</u>	<u>6,100</u>	<u>43</u>	<u>5,475</u>	<u>42</u>	<u>5,475</u>	<u>(1)</u>	<u>0</u>
	Subtotal	42	6,755	43	6,100	43	5,475	42	6,975	(1)	1,500
NIST-106	Building and fire research										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>70</u>	<u>9,088</u>	<u>71</u>	<u>11,422</u>	<u>71</u>	<u>12,035</u>	<u>71</u>	<u>12,035</u>	<u>0</u>	<u>0</u>
	Subtotal	70	9,088	71	11,422	71	12,035	71	12,035	0	0
NIST-116	Computer science and applied mathematics										
	Direct obligations		0		0		0		800		800
	Reimbursable FTE/Obl	<u>72</u>	<u>8,721</u>	<u>74</u>	<u>13,847</u>	<u>74</u>	<u>13,841</u>	<u>68</u>	<u>13,841</u>	<u>(6)</u>	<u>0</u>
	Subtotal	72	8,721	74	13,847	74	13,841	68	14,641	(6)	800

Page No.	Comparison by activity:	1999 Actual		2000 Currently Available		2001 Base		2001 Estimate		Increase/ (Decrease) Over 2001 Base	
		FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount	FTE	Amount
NIST-146	Technology assistance										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>140</u>	<u>18,652</u>	<u>142</u>	<u>17,660</u>	<u>142</u>	<u>17,624</u>	<u>142</u>	<u>17,624</u>	<u>0</u>	<u>0</u>
	Subtotal	140	18,652	142	17,660	142	17,624	142	17,624	0	0
NIST-152	National quality program										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>0</u>	<u>2,369</u>	<u>0</u>	<u>1,600</u>	<u>0</u>	<u>1,600</u>	<u>0</u>	<u>1,600</u>	<u>0</u>	<u>0</u>
	Subtotal	0	2,369	0	1,600	0	1,600	0	1,600	0	0
NIST-160	Research support activities										
	Direct obligations		0		0		0		1,850		1,850
	Reimbursable FTE/Obl	<u>55</u>	<u>27,049</u>	<u>56</u>	<u>8,338</u>	<u>56</u>	<u>8,788</u>	<u>56</u>	<u>8,788</u>	<u>0</u>	<u>0</u>
	Subtotal	55	27,049	56	8,338	56	8,788	56	10,638	0	1,850
	Extramural Programs										
NIST-202	Advanced technology program										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	0	0	0	0	0	0	0	0	0	0
NIST-214	Manufacturing extension partnership										
	Direct obligations		0		0		0		0		0
	Reimbursable FTE/Obl	<u>20</u>	<u>3,509</u>	<u>0</u>	<u>890</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	20	3,509	0	890	0	0	0	0	0	0
NIST-230	Institute for information infrastructure protection										
	Direct obligations		0		0		0		1,600		1,600
	Reimbursable FTE/Obl	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	0	0	0	0	0	0	0	1,600	0	1,600
	Total, National Institute of Standards and Technology										
	Direct obligations		0		0		0		7,800		7,800
	Reimbursable FTE/Obl	<u>732</u>	<u>125,147</u>	<u>722</u>	<u>107,906</u>	<u>722</u>	<u>107,866</u>	<u>714</u>	<u>107,866</u>	<u>(8)</u>	<u>0</u>
	Total	732	125,147	722	107,906	722	107,866	714	115,666	(8)	7,800

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF FINANCING
(Dollar amounts in thousands)

	1999 Actual	2000 Currently Available	2001 Base	2001 Estimate	Increase/ (Decrease) Over 2001 Base
Total Obligations	\$125,147	\$107,906	\$107,866	\$115,666	\$7,800
Financing:					
Offsetting collections from:					
Federal funds	(103,280)	(83,822)	(83,791)	(83,791)	0
Non-Federal sources	(29,675)	(24,084)	(24,075)	(24,075)	0
Recoveries	0	0	0	0	0
Unobligated balance, start of year	(32,799)	(41,005)	(41,005)	(41,005)	0
Unobligated balance transferred					
Unobligated balance, end of year	41,005	41,005	41,005	41,005	0
Unobligated balance lapsing					
Budget Authority	398	0	0	7,800	7,800
Financing:					
Transfer from other accounts	(398)	0	0	(7,800)	(7,800)
Appropriation	0	0	0	0	0

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
JUSTIFICATION OF PROGRAM AND PERFORMANCE

Goal Statement

The Working Capital Fund (WCF) reflects the full-time equivalent (FTE) employment and dollar estimates associated with the reimbursable work performed by NIST for other agencies and the public. In addition, these estimates reflect the transfer of appropriated funds to the WCF for the purchase of invested equipment and the production of Standard Reference Materials. The WCF contains reimbursable obligations and transfers associated with the Scientific and Technical Research and Services Appropriation and the Industrial Technology Services Appropriation.

Base Program

NIST's reimbursable services consist of technical work performed for other Federal agencies, state, and local governments, and the private sector, including calibrations and special tests, advisory services, and the sale of Standard Reference Materials. The unique measurements and standards expertise developed with appropriated funding gives NIST the capability to perform these services on a reimbursable basis. NIST accepts other agency work based on an established set of criteria which include: (1) the need for traceability of measurements to national standards; (2) the need for work which cannot or will not be addressed by the private sector; (3) work supported by legislation that authorizes or mandates certain services; (4) work which would result in an unavoidable conflict of interest if carried out by the private sector or regulatory agencies; and (5) requests by the private sector for NIST action or services.

Performance Measures

Relevant quantitative output measures are presented in the NIST General Statement.

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>1999 Actual</u>	<u>2000 Currently Available</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) Over 2001 Base</u>
11 Personnel compensation					
11.1 Full-time permanent	0	0	0	0	0
11.3 Other than full-time permanent	0	0	0	0	0
11.5 Other personnel compensation	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
11.9 Total personnel compensation	0	0	0	0	0
12.1 Civilian personnel benefits	0	0	0	0	0
13 Benefits for former personnel	0	0	0	0	0
21 Travel and transportation of persons	0	0	0	0	0
22 Transportation of things	0	0	0	0	0
23.1 Rental payments to GSA	0	0	0	0	0
23.2 Rental payments to others	0	0	0	0	0
23.3 Communications, utilities, and miscellaneous charges	0	0	0	0	0
24 Printing and reproduction	0	0	0	0	0
25.1 Advisory and assistance services	0	0	0	0	0
25.2 Other services	0	0	0	0	0
25.3 Purchases of goods and services from Government accounts	0	0	0	0	0
25.5 Research and development contracts	0	0	0	0	0
25.7 Operation and maintenance of equipment	0	0	0	0	0
26 Supplies and materials	0	0	0	0	0
31 Equipment	\$398	0	0	\$7,800	\$7,800
32 Land and structures	0	0	0	0	0
41 Grants, subsidies, and contributions	0	0	0	0	0
42 Insurance claims and indemnities	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
99 Total Obligations	398	0	0	7,800	7,800

<u>Personnel Data</u>	<u>1999 Actual</u>	<u>2000 Currently Available</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) Over 2001 Base</u>
Full-time equivalent employment:					
Full-time permanent	657	647	647	639	(8)
Other than full-time permanent	<u>75</u>	<u>75</u>	<u>75</u>	<u>75</u>	<u>0</u>
Total	732	722	722	714	(8)
Authorized Positions:					
Full-time permanent	682	682	682	671	(11)
Other than full-time permanent	<u>24</u>	<u>24</u>	<u>24</u>	<u>24</u>	<u>0</u>
Total	706	706	706	695	(11)

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Working Capital Fund
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>2001 Adjustment to Base</u>	<u>2001 Base</u>	<u>2001 Estimate</u>	<u>Increase/ (Decrease) Over 2001 Base</u>
31 Equipment				
Office machines and other equipment	0	0	\$5,040	\$5,040
ADP equipment	0	0	2,760	2,760
Equipment depreciation	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal	0	0	7,800	7,800
99 Total Obligations	0	0	7,800	7,800

Department of Commerce
National Institute of Standards and Technology
Working Capital Fund
SCHEDULE OF ADVISORY AND ASSISTANCE SERVICES
(Obligations in thousands of dollars)

	FY 1999 <u>Actual</u>	FY 2000 <u>Estimate</u>	FY 2001 <u>Estimate</u>
Management and Professional Support Services	1,184	1,184	1,184
Studies, analyses, and evaluations	<u>1,190</u>	<u>1,190</u>	<u>1,190</u>
Total	2,374	2,374	2,374

Significant Activities

Advisory and assistance services funded by the Working Capital Fund represent services funded by reimbursable funds in support of reimbursable work conducted at NIST.

Working Capital Fund, National Institute of Standards and Technology (NIST)

The operations of the NIST Working Capital Fund are reported in a program and financing schedule printed in the President's Budget, as well as reflected in the reimbursable amounts throughout this budget. The fund finances the initial costs of work performed by NIST and is reimbursed by applicable appropriations and advances or reimbursements from other agencies. A detailed cost accounting system is used to ensure that the actual cost of work performed for each job or task is recorded and identified with the appropriate source of financing. In addition to its function as a revolving fund, the Working Capital Fund is also used to handle annual and sick leave on an accrued basis, to acquire equipment as an investment to be recovered through depreciation charges to programs, to distribute indirect costs to programs as overhead, to carry the recoverable costs associated with the production of Standard Reference Materials, and to carry supply inventories until issued for program use.

The table below summarizes the total NIST program, according to the source of financing. Following this table is a summary of the NIST reimbursable program by sponsor and source of support.

Summary of Total NIST Program
(Obligations in thousands)

Source and Use of Funds Spent	FY 1999			FY 2000			FY 2001			
	Perm. Pos. 1	FTE	Oblig.	Perm. Pos. 1	FTE	Oblig.	Perm. Pos. 1	FTE	Oblig.	Approp. Requested
<u>Direct Funding</u>										
Scientific and technical research and services	2,047	2,062	\$279,294	1,987	2,048	\$290,076	2,080	2,113	\$332,308	\$337,508
Industrial technology services	377	360	318,244	379	393	316,081	423	425	361,137	339,604
Construction of research facilities	32	27	19,603	32	33	226,386	32	33	35,879	35,879
Gifts and bequests	...	...	8	...	...	8	...	...	8	...
Total, direct funding	2,456	2,449	617,149	2,398	2,474	832,551	2,535	2,571	729,332	712,991
<u>Reimbursable Funding and WCF Investments</u>										
Research, development and supporting services:										
Federal government	427	441	66,428	426	435	70,410	419	431	70,032	
Calibrations and tests, technical and advisory services:										
Federal government	26	27	1,613	26	27	1,525	26	27	1,532	
Public and non-federal government	142	147	23,461	142	144	22,184	139	143	22,287	
Subtotal, Services	168	174	25,074	168	171	23,709	165	170	23,819	
National Voluntary Accreditation Program	26	27	4,212	26	27	4,357	26	26	4,450	
Standard reference materials (SRMs):										
SRM Sales:										
Government	2	3	298	2	2	313	2	2	261	
Public	83	87	8,515	84	87	8,929	83	85	8,981	
Subtotal, SRM sales	85	90	8,813	86	89	9,242	85	87	9,242	
SRM Program adjustments	...	...	1,775	...	...	188	...	...	323	
Subtotal, SRM	85	90	10,588	86	89	9,430	85	87	9,565	
WCF investments and operating adjustments	...	...	18,845	...	...	0	...	...	7,800	
Total, Reimbursable funding and WCF investments	706	732	125,147	706	722	107,906	695	714	115,666	
<u>Total, NIST program</u>	3,162	3,181	742,296	3,104	3,196	940,457	3,230	3,285	844,998	

1 Most NIST scientists and engineers are not engaged solely on one research project. An individual may divide his time between two or more projects financed by different sources of support. Also, salary costs of many staff members are charged to an overhead account and subsequently prorated to all directly funded projects. For these reasons, it is not possible to report employment directly for any source of financing. The Permanent Positions above are statistically-derived numbers, based on the estimated work years distribution for NIST programs.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
REIMBURSABLE PROGRAM BY SOURCE OF SUPPORT
(Dollar amounts in thousands)

	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate
Department of Defense			
Air Force	\$8,671	\$9,156	\$9,201
Army	3,161	3,476	3,556
Navy	3,767	3,044	3,101
Other	<u>11,553</u>	<u>11,382</u>	<u>10,949</u>
Subtotal, Department of Defense	27,152	27,058	26,807
Department of Agriculture	102	116	127
Department of Commerce	7,007	7,463	7,906
Department of Energy	7,199	6,844	6,773
Department of Health & Human Services	1,331	1,591	1,526
Department of Housing & Urban Development	1,357	2,682	2,800
Department of the Interior	949	916	888
Department of Justice	6,158	8,023	7,958
Department of Labor	367	62	101
Department of Transportation	1,198	1,272	1,282
Department of the Treasury	718	336	361
Department of Veterans Affairs	455	723	659
Environmental Protection Agency	1,289	1,806	1,460
Federal Emergency Management Agency	259	350	380
General Services Administration	1,677	1,032	561
National Aeronautics & Space Administration	5,046	5,941	5,980
National Science Foundation	1,519	2,444	2,746
Nuclear Regulatory Commission	427	310	325
Other	<u>2,218</u>	<u>1,441</u>	<u>1,392</u>
Total, Other Agency	66,428	70,410	70,032
Calibrations & Testing	7,992	8,413	8,467
Standard Reference Materials	10,588	9,430	9,565
Technical & Advisory Services	21,294	19,653	19,802
WCF Investments/Operating Adjustments	<u>18,845</u>	<u>0</u>	<u>7,800</u>
Total, Other Reimbursables	58,719	37,496	45,634
Grand Total, Reimbursable Program	125,147	107,906	115,666

Department of Commerce
National Institute of Standards and Technology

PERIODICALS, PAMPHLETS, AND AUDIOVISUAL PRODUCTS
(Obligations in thousands)

	1998 <u>Actual</u>	1999 <u>Actual</u>	2000 <u>Estimate</u>	2001 <u>Estimate</u>
Periodicals	\$12	\$10	\$15	\$19
Pamphlets	81	31	68	108
Audiovisuals.....	<u>2</u>	<u>0</u>	<u>31</u>	<u>5</u>
Total	95	41	114	132

The National Institute of Standards and Technology produces only one periodical - The Journal of Research. *The Journal of Research of the National Institute of Standards and Technology*, issued six times a year, reports NIST research and development in those disciplines of the physical and engineering sciences in which NIST is active (physics, chemistry, engineering, mathematics, and computer sciences).

Department of Commerce
Technology Administration
National Institute of Standards and Technology

Average Salary

	1999 <u>Actual</u>	2000 <u>Estimate</u>	2001 <u>Estimate</u>
Average ES salary	\$122,731	\$128,622	\$133,381
Average Career Path Salary	65,243	67,213	69,416
Average salary of ungraded positions	36,300	38,043	39,451

APPROPRIATION SUMMARY STATEMENT
 DEPARTMENT OF COMMERCE
 TECHNOLOGY ADMINISTRATION
 NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
 Scientific and Technical Research and Services
 Supplemental Budget Request
 Fiscal Year 2000

	Appropriation	Employment	
		FTE	Pos.
Currently Available	\$282,138	2,048	1,987
Proposed Supplemental	1,000	1	0
Revised Estimate	283,138	2,049	1,987

STATEMENT OF PURPOSE AND NEED

The purpose of this supplemental budget request is to establish and begin initial operations of the Critical Infrastructure Protection Expert Review Team (CIP/ERT) program so that the ERT can be fully operational in FY 2001 to address critical Federal agency IT security needs. The need for the ERT is forcefully stated in the recent National Plan for Critical Infrastructure Protection. Waiting until FY 2001 to begin this program will only delay fixing agencies' vulnerabilities and implementing much-needed system protection actions. Since vulnerabilities represent clear and present opportunities for significant harm to the operation of Federal systems and thereby to the economy and services to the citizens, we urgently need to begin these activities.

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

		2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate		
		Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount	
<u>Comparison by activity:</u>								
Measurement and engineering research and standards								
NIST- 5	Electronics and electrical engineering	Pos./Appro	272	\$38,376	0	0	272	\$38,376
		FTE/Obl.	282	39,051	0	0	282	39,051
	Manufacturing engineering	Pos./Appro	140	19,057	0	0	140	19,057
		FTE/Obl.	144	19,299	0	0	144	19,299
	Chemical science and technology	Pos./Appro	225	32,117	0	0	225	32,117
		FTE/Obl.	232	32,481	0	0	232	32,481
	Physics	Pos./Appro	164	28,423	0	0	164	28,423
		FTE/Obl.	169	28,778	0	0	169	28,778
	Materials science and engineering	Pos./Appro	348	51,013	0	0	348	51,013
		FTE/Obl.	358	53,129	0	0	358	53,129
	Building and fire research	Pos./Appro	100	14,732	0	0	100	14,732
		FTE/Obl.	104	14,887	0	0	104	14,887
	Computer science and applied mathematics	Pos./Appro	330	44,232	0	\$1,000	330	45,232
		FTE/Obl.	338	45,267	1	1,000	339	46,267
	Technology assistance	Pos./Appro	118	17,363	0	0	118	17,363
		FTE/Obl.	124	17,708	0	0	124	17,708
	National quality program	Pos./Appro	38	4,903	0	0	38	4,903
		FTE/Obl.	40	5,913	0	0	40	5,913

	2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate	
	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
<u>Comparison by activity:</u>						
Research support activities	Pos./Appro 252	31,922	0	0	252	31,922
	FTE/Obl. 257	33,563	0	0	257	33,563
TOTALS	Pos./Appro 1,987	282,138	0	1,000	1,987	283,138
	FTE/Obl. 2,048	290,076	1	1,000	2,049	291,076
Adjustments to obligations:						
Prior year recoveries		(1,000)		0		(1,000)
Unobligated balance, start of year		(6,938)		0		(6,938)
Unobligated balance, end of year		0		0		0
Financing from transfers:						
Transfers to other accounts (+)		0		0		0
Appropriation		282,138		1,000		283,138

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
(Dollar amounts in thousands)

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics

		2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
<u>Line Item</u> Computer science and applied mathematics	Pos./Approp	330	\$44,232	0	\$1,000	330	\$45,232
	FTE/Obl.	338	45,267	1	1,000	339	46,267

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research Services
FY 2000 Supplemental
(Dollar amounts in thousands)

	2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate	
	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Computer science and applied mathematics .....Pos./Approp	330	\$44,232	0	\$1,000	330	\$45,232
FTE/Obl.	338	45,267	1	1,000	339	46,267

Establishment of critical infrastructure protection (CIP): expert review team (ERT) (0 Permanent Positions, +1 FTE, BA +\$1,000,000, Direct Obligations +\$1,000,000) – To establish and begin initial operations of the Critical Infrastructure Protection Expert Review Team (CIP/ERT). This team of computer security experts will help Federal agencies protect their information systems in accordance with Presidential Decision Directive #63 on critical infrastructure protection and applicable statutes. PDD #63 identifies the Federal government, as one of the critical infrastructures requiring protection, to ensure continued functioning of government, society, and the economy in the face of natural, inadvertent, or purposeful disruptions. The Expert Review Team will help Federal agencies identify and fix existing vulnerabilities in information systems and assist agencies in preparing for future security threats. As discussed in the House of Representatives hearing, “A Review of H.R. 2413 – The Computer Security Enhancement Act of 1999”, held September 30, 1999, the current shortage of computer scientists, including computer security specialists, affects the ability of Federal agencies to acquire needed expertise. This supplemental request will fund staff and start-up expenses to begin forming the ERT and addressing the most pressing vulnerabilities and will share this expertise across the agencies to best use this scarce resource.

With this proposed supplemental funding, NIST will plan, organize, and begin establishing the CIP Expert Review Team to be based at NIST. NIST will develop a detailed team concept of operations, establish staffing requirements, recruit key personnel who are highly skilled in a wide range of IT security issues, and develop needed policies and procedures, including those for the allocation of limited ERT services. The team will begin working with agencies to identify IT system vulnerabilities, the level of assistance needed, and recommend actions to minimize disruptions from natural causes, equipment failures, human error, and cyber threats. The team

will continually consult with the private sector and government information technology (IT) security professionals to ensure the best and most recent skills and knowledge are available to protect government IT resources. The team will be augmented by detailed staff from other agencies to both extend the reach of the team and to ensure optimal exchange of information and technologies among agencies. The ERT's activities will complement, but not supplant, the need for agencies to have in-house day-to-day operational security activities.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Measurement and engineering research and standards
Subactivity: Computer science and applied mathematics
Program Change: CIP expert review team

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer scientist	ZP V	1	84,530	84,530
Computer scientist	ZP IV	4	71,861	287,444
Subtotal		<hr/> 5		<hr/> 371,974
Less lapse	75 %	(4)		(278,981)
Total other than full-time permanent (FTE)		<hr/> 1		<hr/> 92,993
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Other than full-time permanent		1		
Authorized Positions:				
Other than full-time permanent		0		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
11 Personnel compensation			
11.1 Full-time permanent	\$126,014	0	\$126,014
11.3 Other than full-time permanent	11,149	\$93	11,242
11.5 Other personnel compensation	4,266	0	4,266
11.9 Total personnel compensation	<u>141,429</u>	<u>93</u>	<u>141,522</u>
12.1 Civilian personnel benefits	31,054	23	31,077
13 Benefits for former personnel	164	0	164
21 Travel and transportation of persons	6,214	51	6,265
22 Transportation of things	935	11	946
23.1 Rental payments to GSA	62	0	62
23.2 Rental payments to others	2,765	0	2,765
23.3 Communications, utilities, and miscellaneous charges	11,543	28	11,571
24 Printing and reproduction	644	11	655
25.1 Advisory and assistance services	3,517	0	3,517
25.2 Other services	21,060	480	21,540
25.3 Purchases of goods and services from Government accounts	11,985	248	12,233
25.5 Research and development contracts	1,897	0	1,897
25.7 Operation and maintenance of equipment	3,333	5	3,338
26 Supplies and materials	17,226	25	17,251
31 Equipment	23,026	25	23,051
32 Land and structures	843	0	843
41 Grants, subsidies, and contributions	12,379	0	12,379
42 Insurance claims and indemnities	0	0	0
99 Total Obligations	<u>290,076</u>	<u>1,000</u>	<u>291,076</u>

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
99 Total Obligations	290,076	1,000	291,076
Less Prior Year Recoveries	(1,000)	0	(1,000)
Less Prior Year Unobligated Balance	<u>(6,938)</u>	<u>0</u>	<u>(6,938)</u>
Total Budget Authority	282,138	1,000	283,138

Personnel Data

Full-time equivalent employment:

Full-time permanent	1,831	0	1,831
Other than full-time permanent	<u>217</u>	<u>1</u>	<u>218</u>
Total	2,048	1	2,049

Authorized Positions:

Full-time permanent	1,920	0	1,920
Other than full-time permanent	<u>67</u>	<u>0</u>	<u>67</u>
Total	1,987	0	1,987

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Scientific and Technical Research and Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
11 Personnel compensation			
11.1 Full-time permanent			
Executive level	\$131	0	\$131
Senior executive service	4,610	0	4,610
Career path	111,987	0	111,987
Wage board	6,713	0	6,713
Scientific & professional (P.L. 80-313)	<u>2,573</u>	<u>0</u>	<u>2,573</u>
Subtotal	126,014	0	126,014
11.3 Other than full-time permanent			
Career path	9,623	\$93	9,716
Wage board	192	0	192
Scientific & professional (P.L. 80-313)	124	0	124
Experts & consultants	422	0	422
Student	<u>788</u>	<u>0</u>	<u>788</u>
Subtotal	11,149	93	11,242
11.5 Other personnel compensation			
Overtime	1,170	0	1,170
SES performance awards	106	0	106
Cash awards	2,864	0	2,864
Other	<u>126</u>	<u>0</u>	<u>126</u>
Subtotal	4,266	0	4,266
11.9 Total personnel compensation	<u>141,429</u>	<u>93</u>	<u>141,522</u>

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
12.1 Civilian personnel benefits			
Civil service retirement	4,437	3	4,440
Federal employees' retirement	8,958	7	8,965
Thrift savings plan	3,422	3	3,425
Federal Insurance Contribution Act	7,225	6	7,231
Health insurance	5,877	4	5,881
Life insurance	223	0	223
Employees' Compensation Fund	545	0	545
Other	<u>367</u>	<u>0</u>	<u>367</u>
Subtotal	31,054	23	31,077
13 Benefits for former personnel			
Severance pay	121	0	121
Unemployment compensation	<u>43</u>	<u>0</u>	<u>43</u>
Subtotal	164	0	164
21 Travel and transportation of persons			
Common carrier	2,031	17	2,048
Mileage	135	1	136
Per diem/actual	2,879	24	2,903
Other	<u>1,169</u>	<u>9</u>	<u>1,178</u>
Subtotal	6,214	51	6,265
22 Transportation of things	935	11	946
23.1 Rental payments to GSA	62	0	62
23.2 Rental payments to others	2,765	0	2,765

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
23.3 Communications, utilities, and miscellaneous charges			
Rental of ADP equipment	909	0	909
Rental of office copying equipment	164	1	165
Other equipment rental	521	1	522
Federal telecommunications system	357	1	358
Other telecommunications services	1,186	8	1,194
Postal Service by USPS	821	2	823
Utilities:			
Electric	4,967	10	4,977
Gas	1,505	3	1,508
Water/Sewer	<u>1,113</u>	<u>2</u>	<u>1,115</u>
Subtotal	11,543	28	11,571
24 Printing and reproduction			
Publications	413	8	421
Other	<u>231</u>	<u>3</u>	<u>234</u>
Subtotal	644	11	655
25.1 Advisory and assistance services			
Management & professional support services	2,149	0	2,149
Studies, analyses, & evaluation	1,368	0	1,368
Engineering & technical services	<u>0</u>	<u>0</u>	<u>0</u>
Subtotal	3,517	0	3,517
25.2 Other services			
Training	1,497	1	1,498
ADP Services	4,037	1	4,038
[Commerce administrative management system (specific)]	[1,007]	[0]	[1,007]
Other non-government contracts	<u>15,526</u>	<u>478</u>	<u>16,004</u>
Subtotal	21,060	480	21,540
25.3 Purchases of goods and services from Government accounts			
Payments to GA, WCF	7,337	0	7,337
[Commerce administrative management system (shared)]	[1,400]	[0]	[1,400]
Office of Personnel Management	64	0	64
Other Federal agencies:			
Dept. of Commerce	1,042	12	1,054
Other	<u>3,542</u>	<u>236</u>	<u>3,778</u>
Subtotal	11,985	248	12,233

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
25.5 Research and development contracts	1,897	0	1,897
25.7 Operation and maintenance of equipment	3,333	5	3,338
26 Supplies and materials			
Office & laboratory supplies	10,009	25	10,034
Scientific publications & journals	1,526	0	1,526
Fuel oil	48	0	48
Reactor materials	<u>5,643</u>	<u>0</u>	<u>5,643</u>
Subtotal	17,226	25	17,251
31 Equipment			
Office machines and other equipment	2,386	18	2,404
ADP equipment	4,835	7	4,842
Equipment amortization	<u>15,805</u>	<u>0</u>	<u>15,805</u>
Subtotal	23,026	25	23,051
32 Land and structures	843	0	843
41 Grants, subsidies, and contributions	12,379	0	12,379
42 Insurance claims and indemnities	0	0	0
99 Total Obligations	<u>290,076</u>	<u>1,000</u>	<u>291,076</u>
Less Prior Year Recoveries	(1,000)	0	(1,000)
Less Prior Year Unobligated Balance	<u>(6,938)</u>	<u>0</u>	<u>(6,938)</u>
Total Budget Authority	282,138	1,000	283,138

APPROPRIATION SUMMARY STATEMENT
 DEPARTMENT OF COMMERCE
 TECHNOLOGY ADMINISTRATION
 NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
 Industrial Technology Services
 Supplemental Budget Request
 Fiscal Year 2000

	Appropriation	Employment	
		FTE	Pos.
Currently Available	\$246,780	393	379
Proposed Supplemental	4,000	3	0
Revised Estimate	250,780	396	379

STATEMENT OF PURPOSE AND NEED

The funding requested in this supplemental appropriation request is needed to establish and begin operations of the Institute for Information Infrastructure Protection (IIIP). The Institute will support research and development for protection of the Nation's critical information infrastructures by collaborating with industry and universities through the provision of research grants. The Institute is being established to support Presidential Decision Directive (PDD) #63, dated May 22, 1998, the report of the President's Commission on Critical Infrastructure Protection (PCCIP), and the President's *National Plan for Information Systems Protection* (Version 1.0, January 2000). The Institute, to be funded through NIST, will lead a partnership among industry, academia, and government to develop the technology and knowledge necessary to provide appropriate protection for our Nation's critical infrastructures. Full-scale operations are planned to begin in FY 2001; this supplemental budget will enable NIST to conduct the activities necessary to organize and prepare for that full-scale operation.

The need for the Institute and the research products that it will produce has been cited repeatedly in the various reports of the President's commission and other sources. The principal funding for the Institute initiative is included in the President's FY 2001 budget request. However, supplemental funds are urgently needed in FY 2000 to prepare for the full operations of the Institute, including staffing, initial planning, and awarding grants addressing high-priority issues identified by the Administration. The President's recently issued National Plan (cited above) establishes a timeline that simply cannot be met with current FY 2000 resources.

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Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF RESOURCE REQUIREMENTS
(Dollar amounts in thousands)

			2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate	
			Per- sonnel	Amount	Per- sonnel	Amount	Per- sonnel	Amount
<u>Comparison by activity:</u>								
Extramural programs								
NIST SUPP-19	Advanced technology program	Pos./Approp	270	\$142,600	0	0	270	\$142,600
		FTE/Obl.	280	211,000	0	0	280	211,000
	Manufacturing extension partnership	Pos./Approp	109	104,180	0	0	109	104,180
		FTE/Obl.	113	105,081	0	0	113	105,081
	Institute for information infrastructure protection	Pos./Approp	0	0	0	\$4,000	0	4,000
		FTE/Obl.	0	0	3	4,000	3	4,000
	TOTALS	Pos./Approp	379	246,780	0	4,000	379	250,780
		FTE/Obl.	393	316,081	3	4,000	396	320,081
	Adjustments to obligations:							
	Prior year recoveries			(20,000)				(20,000)
Unobligated balance, start of year				(68,634)			(68,634)	
Unobligated balance, end of year				19,333			19,333	
Financing from transfers:								
Transfers to other accounts (+)								
Transfers from other accounts (-)								
Appropriation				246,780		4,000		250,780

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Department of Commerce
 Technology Administration
 National Institute of Standards and Technology
 Industrial Technology Services
PROGRAM AND PERFORMANCE: DIRECT OBLIGATIONS
 (Dollar amounts in thousands)

Activity: Extramural programs

Subactivity: Institute for information infrastructure protection

<u>Line Item</u>		2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate	
		<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>	<u>Per- sonnel</u>	<u>Amount</u>
Institute for information infrastructure protection	Pos./Approp	0	0	0	\$4,000	0	\$4,000
	FTE/Obl.	0	0	3	4,000	3	4,000

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
FY 2000 Supplemental
(Dollar amounts in thousands)

		2000 Currently Available		2000 Proposed Supplemental		2000 Revised Estimate	
		<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>	<u>Personnel</u>	<u>Amount</u>
Institute for information							
infrastructure protection (IIIP)							
	Pos./Approp			0	\$4,000	0	\$4,000
	FTE/Obl.			3	4,000	3	4,000

Establishment activities for the institute for information infrastructure protection (IIIP) (0 Permanent Positions, +3 FTE, BA +\$4,000,000, Direct Obligations +\$4,000,000) - To establish and begin operations of the Institute for Information Infrastructure Protection (IIIP). The Institute will support research and development for protection of the Nation's critical information infrastructures by collaborating with industry and universities through the provision of research grants. The Institute supports the President's *National Plan for Information Systems Protection* (Version 1.0, January 2000). The Institute, to be funded through NIST, will lead a partnership among industry, academia, and government to develop the technology and knowledge necessary to provide appropriate protection for our critical information infrastructures. This Institute will focus research on the most needed areas, which is essential given the current shortage IT professionals, including computer security professionals. These issues were recognized in the House of Representatives hearing "A Review of H.R. 2413 – The Computer Security Enhancement Act of 1999" held on September 30, 1999.

Although the principal funding for the Institute initiative is included in the President's FY 2001 budget request, there is an urgent need for start-up funds in FY 2000 to prepare for the full operations of the Institute, to begin initial planning, and to issue initial grants in FY 2000.

With the proposed funding, NIST will solicit and award a small number of initial grants in FY 2000 to address high priority issues raised by the Administration, and conduct program planning, management and startup activities. The Institute will complement NIST's current and planned activities for Critical Infrastructure Protection (CIP), including the development of Federal standards, guidelines, and measurements which support the improvement of the security, reliability, and survivability of critical infrastructure systems.

This initiative is designed to identify appropriate Federal investments in information infrastructure-related R&D and provide a strong and secure foundation to protect the various critical infrastructures upon which the Nation's security and economy rely. The Institute's R&D will focus on work that can be applied to protect multiple sectors' infrastructures, and thus will complement sector-specific R&D underway elsewhere in the government and private sector. Therefore, extensive discussions with industry and sector representatives will be necessary in order to structure the Institute to meet the needs of both government and industry.

The Institute will develop and maintain a knowledge base for the identification of high-priority information infrastructure R&D activities, solicit proposals, grant awards, and disseminate R&D products in a timely and effective manner. The Institute will continually seek out other communities and experts who may contribute to the Institute's activities and will engage other Federal agency-based information infrastructure research efforts to identify opportunities for synergistic cooperation, help disseminate NIST and other agency R&D work, and avoid duplication of effort.

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
PROGRAM CHANGE PERSONNEL DETAIL

Activity: Extramural programs
Subactivity: Institute for information infrastructure protection
Program Change: Institute for information infrastructure protection

<u>Title</u>	<u>Grade</u>	<u>Number</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Computer specialist	ZP V	6	84,530	507,180
Physical scientist	ZP V	3	84,530	253,590
Program deputy director	ZP V	1	84,530	84,530
Program director	ZP V	1	84,530	84,530
Senior management advisor	ZA V	1	84,530	84,530
Computer specialist	ZP IV	13	71,861	934,193
Physical scientist	ZP IV	3	71,861	215,583
Information specialist	ZA III	3	51,138	153,414
Mathematician	ZP III	5	51,138	255,690
Secretary	ZS V	1	38,836	38,836
Administrative officer	ZA II	1	35,265	35,265
Administrative/technical support	ZA II	3	35,265	105,795
Secretary	ZS IV	1	31,927	31,927
Subtotal		42		2,785,063
Less lapse	25 %	(11)		(697,266)
Total full-time permanent (FTE)		31		2,087,797
2001 Pay Adjustment (3.7%)				77,286
Total				2,165,083
<u>Personnel Data</u>				
Full-Time Equivalent Employment:				
Full-time permanent		31		
Authorized Positions:				
Full-time permanent		42		

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
SUMMARY OF REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
11 Personnel compensation			
11.1 Full-time permanent	\$24,657	\$201	\$24,858
11.3 Other than full-time permanent	1,753	0	1,753
11.5 Other personnel compensation	583	0	583
11.9 Total personnel compensation	<u>26,993</u>	<u>201</u>	<u>27,194</u>
12.1 Civilian personnel benefits	5,362	49	5,411
13 Benefits for former personnel	11	0	11
21 Travel and transportation of persons	1,559	250	1,809
22 Transportation of things	130	11	141
23.1 Rental payments fo GSA	17	0	17
23.2 Rental payments to others	660	2	662
23.3 Communications,utilities, and miscellaneous charges	2,602	53	2,655
24 Printing and reproduction	207	33	240
25.1 Advisory and assistance services	3,728	0	3,728
25.2 Other services	9,554	774	10,328
25.3 Purchases of goods and services from Government accounts	6,530	509	7,039
25.5 Research and development contracts	55	0	55
25.7 Operation and maintenance of equipment	250	14	264
26 Supplies and materials	1,939	31	1,970
31 Equipment	2,890	73	2,963
32 Land and structures	66	0	66
41 Grants, subsidies and contributions	253,525	2,000	255,525
42 Insurance claims and indemnities	3	0	3
99 Total obligations	<u>316,081</u>	<u>4,000</u>	<u>320,081</u>

<u>Object Class</u>		2000 Currently Available	2000 Proposed Supplemental	2000 Revised Estimate
99	Total obligations	316,081	4,000	320,081
	Less: prior year unobligated balance	(68,634)	0	(68,634)
	Less: prior year recoveries	(20,000)	0	(20,000)
	Unobligated balance EOY	19,333	0	19,333
	Total Budget Authority	246,780	4,000	250,780
<u>Personnel Data</u>				
	Full-time equivalent employment:			
	Full-time permanent	356	0	356
	Other than full-time permanent	37	3	40
	Total	393	3	396
	Authorized Positions:			
	Full-time permanent	366	0	366
	Other than full-time permanent	13	0	13
	Total	379	0	379

Department of Commerce
Technology Administration
National Institute of Standards and Technology
Industrial Technology Services
DETAILED REQUIREMENTS BY OBJECT CLASS
(Dollar amounts in thousands)

<u>Object Class</u>		<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
11	Personnel compensation			
11.1	Full-time permanent			
	Executive level			
	Senior executive service	\$1,103	0	\$1,103
	Career path	23,554	\$201	23,755
	Wage board	0	0	0
	Scientific & professional (P.L. 80-313)	0	0	0
	Subtotal	24,657	201	24,858
11.3	Other than full-time permanent			
	Career path	1,676	0	1,676
	Wage board	0	0	0
	Scientific & professional (P.L. 80-313)	0	0	0
	Experts & consultants	0	0	0
	Student	77	0	77
	Subtotal	1,753	0	1,753
11.5	Other personnel compensation			
	Overtime	206	0	206
	SES performance awards	25	0	25
	Cash awards	352	0	352
	Other	0	0	0
	Subtotal	583	0	583
11.9	Total personnel compensation	26,993	201	27,194

<u>Object Class</u>		<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
12.1	Civilian personnel benefits			
	Civil service retirement	770	6	776
	Federal employees' retirement	1,524	16	1,540
	Thrift savings plan	581	5	586
	Federal Insurance Contribution Act	1,219	12	1,231
	Health insurance	1,000	9	1,009
	Life insurance	38	0	38
	Employees' Compensation Fund	172	1	173
	Other	<u>57</u>	<u>1</u>	<u>58</u>
	Subtotal	5,362	49	5,411
13	Benefits for former personnel			
	Severance pay	0	0	0
	Unemployment compensation	11	0	11
	Other	<u>0</u>	<u>0</u>	<u>0</u>
	Subtotal	11	0	11
21	Travel and transportation of persons			
	Common carrier	567	89	656
	Mileage	41	6	47
	Per diem/actual	619	106	725
	Other	<u>331</u>	<u>49</u>	<u>380</u>
	Subtotal	1,559	250	1,809
22	Transportation of things	130	11	141
23.1	Rental Payments to GSA	17	0	17
23.2	Rental payments to others	660	2	662

Object Class	2000 Currently Available	2000 Proposed Supplemental	2000 Revised Estimate
23.3 Communications, utilities, and miscellaneous charges			
Rental of ADP equipment	8	0	8
Rental of office copying equipment	46	2	48
Other equipment rental	122	1	123
Federal telecommunications system	106	2	108
Other telecommunications services	260	15	275
Postal Service by USPS	233	3	236
Utilities:			
Electric	1,188	20	1,208
Gas	368	6	374
Water/Sewer	<u>271</u>	<u>4</u>	<u>275</u>
Subtotal	2,602	53	2,655
24 Printing and reproduction			
Publications	198	23	221
Other	<u>9</u>	<u>10</u>	<u>19</u>
Subtotal	207	33	240
25.1 Advisory and assistance services			
Management & professional support services	2,947	0	2,947
Studies, analyses, & evaluation	<u>781</u>	<u>0</u>	<u>781</u>
Subtotal	3,728	0	3,728
25.2 Other services			
Training	328	18	346
ADP Services	752	16	768
Other non-government contracts	<u>8,474</u>	<u>740</u>	<u>9,214</u>
Subtotal	9,554	774	10,328
25.3 Purchases of goods and services from Government accounts			
Payments to GA, WCF	1,234	0	1,234
Office of Personnel Management	15	0	15
Other Federal agencies:	456	0	456
Dept. of Commerce	257	57	314
Other	<u>4,568</u>	<u>452</u>	<u>5,020</u>
Subtotal	6,530	509	7,039

	<u>Object Class</u>	<u>2000 Currently Available</u>	<u>2000 Proposed Supplemental</u>	<u>2000 Revised Estimate</u>
25.5	Research and development contracts	55	0	55
25.7	Operation and maintenance of equipment	250	14	264
26	Supplies and materials			
	Office & laboratory supplies	1,563	31	1,594
	Scientific publications & journals	365	0	365
	Fuel oil	<u>11</u>	<u>0</u>	<u>11</u>
	Subtotal	1,939	31	1,970
31	Equipment			
	Office machines and other equipment	197	13	210
	ADP equipment	512	60	572
	Equipment amortization	<u>2,181</u>	<u>0</u>	<u>2,181</u>
	Subtotal	2,890	73	2,963
32	Land and structures	66	0	66
41	Grants, subsidies and contributions	253,525	2,000	255,525
42	Insurance claims and indemnities	3	0	3
99	Total Obligations	<u>316,081</u>	<u>4,000</u>	<u>320,081</u>
	Less: prior year unobligated balance	(68,634)	0	(68,634)
	Less: prior year recoveries	(20,000)	0	(20,000)
	Unobligated balance EOY	<u>19,333</u>	<u>0</u>	<u>19,333</u>
	Total Budget Authority	<u>246,780</u>	<u>4,000</u>	<u>250,780</u>